VERTICAL PROFILES OF VELOCITY AND SUSPENDED SEDIMENT IN STREAMS NEAR MOUNT ST. HELENS, WASHINGTON

By Randy Dinehart

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FACTORS FOR CONVERTING INCH-POUND UNITS TO INTERNATIONAL SYSTEM UNITS (SI)

The following factors may be used to convert the inch-pound units published herein to the International System of Units (SI). This report contains both the inch-pound and SI unit equivalents in the station manuscript descriptions.

Multiply inch-pound units	By	To obtain SI units
	Length	
inches (in)	2.54×10^{1}	millimeters (mm)
	2.54×10^{-2}	meters (m)
feet (ft)	3.048×10^{-1}	meters (m)
miles (mi)	1.609×10^{0}	kilometers (km)
	Area	
acres	4.047×10^{3}	square meters (m^2)
	4.047×10^{-1}	square hectometers (hm^2)
	4.047×10^{-3}	square kilometers (km^2)
square miles (mi^2)	2.590×10^{0}	square kilometers (km^2)
	Volume	
gallons (gal)	3.785×10^{0}	liters (L)
	3.785×10^{0}	cubic decimeters (dm^3)
	3.785×10^{-3}	cubic meters (m^3)
million gallons	3.785×10^{3}	cubic meters (m^3)
	3.785×10^{-3}	cubic hectometers (hm^3)
cubic feet (ft^3)	2.832×10^{1}	cubic decimeters (dm^3)
	2.832×10^{-2}	cubic meters (m^3)
acre-feet (acre-ft)	1.233×10^{3}	cubic meters (m^3)
	1.233×10^{-3}	cubic hectometers (hm^3)
	1.233×10^{-6}	cubic kilometers (km^3)
	Flow	
cubic feet per second (ft^3/s)	2.832×10^{1}	liters per second (L/s)
	2.832×10^{1}	cubic decimeters per second (dm^3/s)
	2.832×10^{-2}	cubic meters per second (m^3/s)
gallons per minute (gal/min)	6.309×10^{-2}	liters per second (L/s)
	6.309×10^{-2}	cubic decimeters per second (dm^3/s)
	6.309×10^{-5}	cubic meters per second (m^3/s)
million gallons per day	4.381×10^{1}	cubic decimeters per second (dm^3/s)
	4.381×10^{-2}	cubic meters per second (m^3/s)
	Mass	
tons (short)	9.072×10^{-1}	megagrams (Mg) or metric tons

VERTICAL PROFILES OF VELOCITY AND SUSPENDED SEDIMENT IN STREAMS NEAR MOUNT ST. HELENS, WASHINGTON

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ABSTRACT

Vertical profiles of high suspended-sediment concentrations and high velocities in streams near Mount St. Helens were measured between January 1981 and May 1986 at seven gaging stations. Data-collection methods are described and the numerical data are tabulated and plotted. Values for the exponent of the sediment-distribution equation were computed for several sand-size ranges using the least-squares method. Logarithms of concentration of a size class at various depths (y) are plotted versus the logarithms of D-y/y (D = flow depth). The ratio of point velocity to mean velocity is plotted versus normalized depth. Selected plots of the logarithms of concentration of fine sand (0.125 to 0.250 millimeters) versus normalized depth (height above streambed / depth) show the vertical distribution of a predominant sediment-size range.

INTRODUCTION

On May 18, 1980, the eruption of Mount St. Helens resulted in the deposition of enormous quantities of highly erodible sediments in streams of the Toutle River basin and other streams near the mountain. The unusual combination of Pacific Northwest hydrology with the abundant sediments of the devastated watersheds presented the opportunity to measure the vertical distributions of high suspended-sediment concentrations and high stream velocities. Data for 27 measurements of vertical sediment distribution and 20 measurements of vertical velocity distribution are presented in this report for the Toutle River at Tower Road, Washington (14242580). Measured suspended-sediment concentrations range from 1,440 to 148,000 mg/L (milligrams per liter); measured mean velocities in the vertical range from 2.66 to 11.91 ft/s (feet per second), for stream discharges from 1,320 to 14,000 ft^3/s (cubic feet per second). Data were collected at this station from January 1982 through June 1985 for research purposes and in response to requests from the U.S. Army Corps of Engineers for vertical-profile data. Vertical-profile data also were collected at the following gaging stations:

14216350 Muddy River above Clear Creek near Cougar
14240800 Green River above Beaver Creek near Kid Valley
14241100 North Fork Toutle River at Kid Valley
14241490 South Fork Toutle River at Camp 12 near Toutle
14242690 Toutle River at Highway 99 bridge near Castle Rock
14243000 Cowlitz River at Castle Rock

Acknowledgments

Many of the vertical-profile measurements presented here were made by the staff of the Hydrologic Surveillance Section of the Vancouver Project Office, outside of their normal duties. The special data-collection program for Toutle River at Tower Road and North Fork Toutle River at Kid Valley was knowledgably directed by C. A. Onions. The manuscript and data format of this report were improved with colleague reviews by R. D. Jarrett and D. W. Hubbell of the U.S. Geological Survey.

DATA-COLLECTION METHODS AND DATA PRESENTATION

Vertical-profile data from five equal-discharge centroids of a cross section were obtained during 1982 at seven gaging stations (fig. 1). At the time of the profile measurements, flow conditions were nearly steady, so measurements represent the cross section for a single discharge. During rapidly changing stream conditions, such as storm runoff, data were measured repeatedly at a single vertical near the center of streamflow in order to reduce the time required to collect vertical-profile data.

In this report, a description of each gaging-station reach is followed by the tabulated data and selected plots of suspended-sediment and velocity distribution. Vertical-profile data sets from each station are identified by a sequential file number.

Suspended-sediment Distribution

Suspended-sediment samples were collected at points in the stream vertical with a US P-61 or P-63 point-integrating sampler (Guy and Norman, 1970). After stream depth was sounded by lowering the sampler to the streambed, the first point-integrated sample was collected near the bed. Special effort was made to collect several samples near the bed. Subsequent samples were collected at progressively higher points above the bed. The particle-size distributions of most suspended-sediment samples collected in the vertical were determined by wet sieving or by visual-accumulation tube. For some samples, however, only the percentage of sediment finer than 0.062 mm was determined. A velocity profile was usually measured at the same vertical where sediment samples were collected, although heights above streambed may not be the same for sediment and velocity profiles. Velocity-profile data are not available for many of the sediment-profile measurements.

Times of collection are given for each sample in the tables. If the given times are identical for a group of samples, the time represents the mean time of sampling for the group. If values for both sediment concentration and velocity are shown, the time of sediment-sample collection is given.

Fine sand (0.125 to 0.250 mm) generally is the most abundant sand size in suspension above the bed. The vertical distribution of fine-sand concentration above the bed is plotted adjacent to the vertical-velocity profiles for selected data sets.

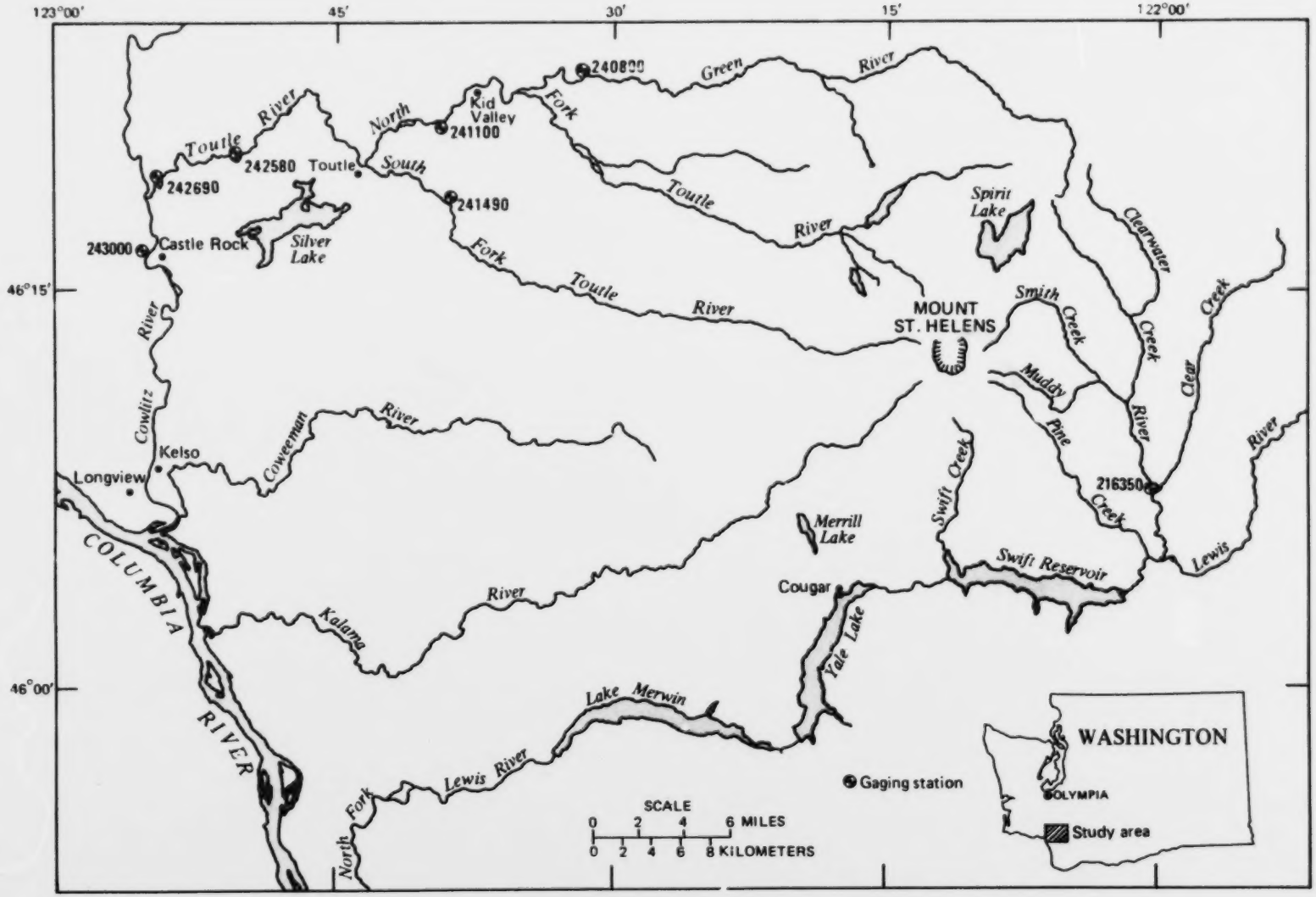

Figure 1.--Gaging station locations near Mount St. Helens where vertical-profile data were collected.

Velocity Distribution

Velocities were measured at different elevation points in the stream vertical with a Price AA current meter for time intervals from about 20 to 60 seconds. The mean velocity at each vertical was computed by a polygonal method from only measured velocities; no extrapolated velocities were used in the computations. Dimensionless height above streambed (height above streambed / depth) is plotted versus the ratio of point velocity to mean velocity in the vertical. Examples of logarithmic and irregular velocity distributions are shown in figure 2. The velocity graphs often show an abrupt increase in the point velocity/mean velocity ratio near the water surface (dimensionless height = 1.0). Point velocities measured near the water surface by the Price AA current meter may be unreliable (Marchand and others, 1984). Under some conditions, the Price AA current meter may underregister when placed closer than 0.5 foot to the water surface (Rantz and others, 1982). Marchand and others (1984) note that recorded velocity also may be greater than the actual longitudinal velocity due to the registration of vertical velocity components by the Price AA current meter in turbulent, high-gradient streams.

Concurrent Data

Water-surface slope, stream discharge, and stream temperature are given for the times of each vertical-profile measurement. At Toutle River at Tower Road and at North Fork Toutle River at Kid Valley, water-surface slopes for the reach between the bridge and the cableway at each site were determined from stage readings at both points. Water-surface profiles were surveyed by levels in June 1982 at all sites except Toutle River at Tower Road. Some water-surface slopes at Cowlitz River at Castle Rock were determined from water-surface profiles surveyed during channel cross-section measurements.

Stream discharge was determined either by direct measurement or by standard rating methods (Kennedy, 1983) for times that vertical-profile data were collected. Stream temperatures, which were measured occasionally during each period of data collection, were used in determining fall velocities of sediment size classes.

Computation of Z_1

A theoretical equation for the distribution of suspended sediment was developed by Rouse (1937) from consideration of a one-dimensional sediment-diffusion equation and the logarithmic velocity-distribution equation. The sediment-distribution equation, which pertains to particles of a narrow size class, is:

$$\frac{C_y}{C_a} = \left(\frac{D - y}{y} \cdot \frac{a}{D - a} \right)^Z \qquad (1)$$

where,

C_y = concentration of particles in the size class at depth y, above bed;

C_a = concentration of particles in the size class at reference level a, above bed;

D = flow depth at the vertical; and

Z = theoretical exponent of the distribution equation.

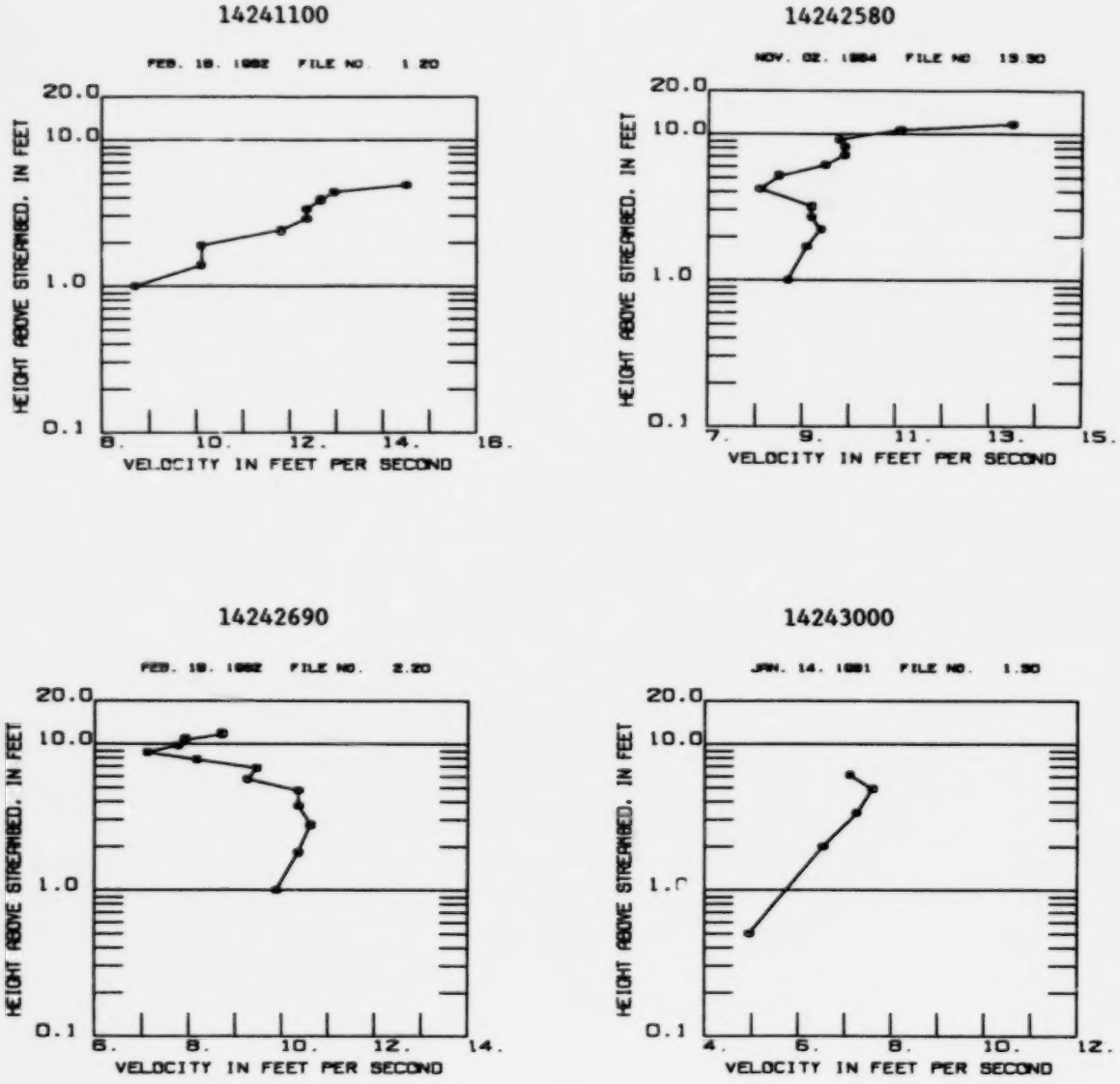

Figure 2.--Examples of vertical velocity distributions in streams near Mount St. Helens.

The concentration of suspended sands in the vertical decreases at progressively higher points above the streambed in accordance with equation 1. In equation 1,

$$Z = \frac{V_s}{kU_*} \qquad (2)$$

in which

$$U_* = \sqrt{gDSe}$$

where

V_s - fall velocity of the geometric mean size of a sediment size class,
k - von Karman coefficient of turbulent exchange, and
Se - the energy gradient.

If D is the full depth at a stream vertical and y is any height above the streambed, then according to equation 1 the logarithms of concentrations of a size class at various y's can be plotted against the logarithms of corresponding values of (D-y)/y, and a straight line can be fitted to the points. The slope of the line is referred to as Z_1, the observed exponent of the suspended-sediment distribution. The subscript 1 differentiates this measured exponent from the theoretical exponent, Z, of the Rouse equation.

In this report, the measured values of Z_1 were derived by a linear regression of log (D-y)/y versus the logarithm of sediment concentration in a size class, with log (D-y)/y as the dependent variable. With this method, all sediment samples were applied without bias to derive the slope of the concentration-distribution equation. Deviations from the logarithmic distribution, which are apparent in a number of data sets, most likely are due to fluctuations in sediment concentration near the streambed and to erroneous concentrations caused by contact of the sediment sampler nozzle with moving sand dunes. These deviations could not be corrected without further information, so they were included in the regressions. Values of Z_1, determined from 3 or more concentrations, are listed with the vertical-profile data. In the data tables, Z_1 is written Z1.

Several investigators (Einstein and Chien, 1954; Nordin and Dempster, 1963) have noted that differences between theoretical values of Z and measured values of Z increase with increasing particle size. The variation has been ascribed to differing values of von Karman k, which is thought to decrease with increasing suspended-sediment concentration (Vanoni, 1946). More recently, Coleman (1981) has suggested that, while the velocity profile shape may be changed by the presence of suspended sediment, von Karman k is "independent of the amount of suspended sediment in an open channel flow". In this report, theoretical values of Z were computed with a constant von Karman k value of 0.40. The values of Z_1 and Z are summarized by location and date in table 1 and are plotted in figures 3 and 4.

Nordin and Dempster (1963) found that, for the Rio Grande, "...the suspended sediment is distributed more uniformly than conventional theory predicts". Figure 3 indicates that the opposite may be true for the North Fork Toutle River at Kid Valley, where conventional theory underpredicts the values of Z_1. Figure 4 shows that the measured and theoretical values for the Toutle River at Tower Road center around the line of equal value.

DISCUSSION

Vertical distributions of velocity and suspended sediment have been measured in many streams; for example, measurements were made in the Niobrara River near Cody, Nebraska by Colby and Hembree (1955) and in the Middle Loup River near Dunning, Nebraska by Hubbell and Matejka (1959). The maximum values of velocity and sediment concentration measured in these two streams were generally lower than those measured in streams near Mount St. Helens. Sediment concentrations comparable to those presented in this report were measured in vertical profiles in the Rio Grande (Nordin and Dempster, 1963), although velocities were lower and depths were shallower. Vertical distributions also have been measured in the deep channels of the Mississippi River (Scott and Stephens, 1966). In the Mississippi River, bedforms do not distort the vertical distribution, except near the bottom, and the distributions of both velocity and sediment concentration correspond closely to theoretical distributions. In contrast, the vertical distributions measured in the Toutle River are affected greatly by the bedforms and deviations from theoretical distributions are common. The presence of bedforms affected the profile measurements in the following ways:

(1) The velocity-measuring procedure and the inherent variation of stream velocity over a dune bed were probably responsible for deviations from the theoretical logarithmic distribution of velocity in the vertical. Under certain flow conditions, velocity distributions at fixed locations change continuously with the passage of bedforms and associated surface waves. Because the velocity measurements were not correlated with the position of bedforms and were not synchronized with any cyclic movement of the waves, some distributions may have been distorted.

(2) Turbulent eddies shed from various-sized bedforms generate concentrated pulses of sediment ("boils") into the streamflow at random intervals. These boils, which originate at the bed and traverse upward to the water surface, cause short-term variations in the sediment distribution for the entire vertical column.

(3) The sand bed is difficult to detect with a cable-mounted sediment sampler, so suspended-sediment samples collected near the bed sometimes are contaminated with bed material from the protruding dunes.

The vertical-profile data in this report were obtained as a part of preliminary sediment investigations being conducted at several streams near Mount St. Helens. As a result of the early analyses, data-collection methods have been improved, and the relation between bedforms, depth, and vertical distributions is being given special attention in the field.

Table 1.--Measured and theoretical values of sediment-distribution exponent Z

[Z_1 = measured; Z = theoretical]

Date	Time	Percent of flow at section	Depth (ft)	No. of samples	Slope	Mean velocity (ft/s)	Values of Z for size class		
							0.062-0.125 mm	0.125-0.250 mm	0.250-0.500 mm
Muddy River above Clear Creek near Cougar (14216350)									
July 13, 1982	--	10	1.9	7	0.00600	3.81	Z_1: -0.071	0.296	0.511
							Z: 0.074	0.248	0.578
		30	3.1	9	.00600	4.49	Z_1: -0.089	-0.036	-0.001
							Z: 0.058	0.194	0.452
		50	3.6	10	.00600	4.33	Z_1: -0.095	-0.052	0.107
							Z: 0.054	0.180	0.420
		70	4.0	9	.00600	4.43	Z_1: -0.077	0.195	0.721
							Z: 0.051	0.171	0.398
Green River above Beaver Creek near Kid Valley (14240800)									
June 17, 1982	--	10	3.7	5	.00150	--	Z_1: -0.002	0.155	-0.111
							Z: 0.108	0.367	0.828
		30	3.8	8	.00150	--	Z_1: 0.115	0.142	0.401
							Z: 0.105	0.362	0.817
		50	2.9	8	.00150	--	Z_1: 0.142	0.187	0.131
							Z: 0.120	0.414	0.935
		70	3.4	10	.00150	--	Z_1: 0.021	0.374	0.838
							Z: 0.111	0.382	0.864
		90	3.1	9	.00150	--	Z_1: 0.134	0.402	0.755
							Z: 0.116	0.400	0.904
North Fork Toutle River at Kid Valley (14241100)									
June 7, 1982	--	10	1.5	6	.00483	5.52	Z_1: 0.057	0.126	0.237
							Z: 0.089	0.305	0.724
		30	1.4	5	.00483	6.58	Z_1: 0.100	0.554	1.083
							Z: 0.091	0.316	0.750
		50	1.8	7	.00483	5.50	Z_1: 0.085	0.235	0.724
							Z: 0.080	0.279	0.662

Table 1.--Measured and theoretical values of sediment-distribution exponent Z--Continued

[Z_1 = measured; Z = theoretical]

Date	Time	Percent of flow at section	Depth (ft)	No. of samples	Slope	Mean velocity (ft/s)	Values of Z for size class 0.062-0.125 mm	0.125-0.250 mm	0.250-0.500 mm
North Fork Toutle River at Kid Valley (14241100)									
June 7, 1982	--	70	2.0	9	0.00483	8.20	Z_1: 0.139	0.385	0.597
							Z: 0.077	0.264	0.714
		90	2.1	9	.00483	7.23	Z_1: 0.113	0.369	0.697
							Z: 0.074	0.257	0.612
Feb. 12, 1986	1255-1318	--	3.3	7	.00500	--	Z_1: 0.023	0.298	0.625
							Z: 0.052	0.178	0.445
Feb. 14, 1986	1217-1237	--	3.2	7	.00500	--	Z_1: 0.055	0.231	0.630
							Z: 0.049	0.177	0.451
Feb. 14, 1986	1241-1300	--	3.2	7	.00500	--	Z_1: -0.018	0.146	0.462
							Z: 0.049	0.177	0.451
Feb. 14, 1986	1315-1328	--	--	7	.00500	--	Z_1: 0.048	0.137	0.362
							Z: 0.049	0.177	0.451
Feb. 14, 1986	1331-1342	--	--	7	.00500	--	Z_1: 0.102	0.344	0.625
							Z: 0.049	0.177	0.451
Feb. 18, 1986	1618-1633	--	--	7	.00409	--	Z_1: -0.214	0.042	0.815
							Z: 0.042	0.151	0.385
Feb. 24, 1986	1209-1219	--	--	5	.00332	--	Z_1: 0.004	0.199	0.317
							Z: 0.049	0.176	0.433
Feb. 24, 1986	1230-1243	--	--	6	.00332	--	Z_1: 0.085	0.199	0.357
							Z: 0.053	0.188	0.456
Feb. 24, 1986	1341-1403	--	--	5	.00332	--	Z_1: 0.053	0.179	0.397
							Z: 0.055	0.192	0.479
Feb. 24, 1986	1345-1406	--	--	5	.00332	--	Z_1: 0.022	0.154	0.103
							Z: 0.055	0.192	0.479
Feb. 27, 1986	1446-1518	--	--	6	.00377	--	Z_1: 0.052	0.442	0.954
							Z: 0.065	0.230	0.537
Feb. 27, 1986	1449-1520	--	--	6	.00377	--	Z_1: 0.066	0.429	0.891
							Z: 0.065	0.230	0.537

Table 1.--Measured and theoretical values of sediment-distribution exponent Z--Continued

[Z_1 = measured; Z = theoretical]

Date	Time	Percent of flow at section	Depth (ft)	No. of samples	Slope	Mean velocity (ft/s)	Values of Z for size class 0.062-0.125 mm	0.125-0.250 mm	0.250-0.500 mm
North Fork Toutle River at Kid Valley (14241100)									
May 6, 1986	1220-1233	--	--	7	0.00446	--	Z_1: 0.047	0.140	0.483
							Z: 0.059	0.203	0.480
May 6, 1986	1250-1303	--	--	7	.00446	--	Z_1: 0.009	0.076	0.373
							Z: 0.057	0.197	0.466
May 6, 1986	1314-1324	--	--	7	.00446	--	Z_1: 0.092	0.216	0.410
							Z: 0.059	0.203	0.480
May 6, 1986	1335-1345	--	--	5	.00446	--	Z_1: 0.140	0.274	0.636
							Z: 0.063	0.217	0.513
May 6, 1986	1352-1359	--	--	5	.00446	--	Z_1: 0.128	0.436	0.960
							Z: 0.063	0.217	0.513
May 6, 1986	1402-1409	--	--	5	.00446	--	Z_1: 0.028	0.257	0.627
							Z: 0.063	0.217	0.513
May 21, 1986	1255-1306	--	--	5	.00436	--	Z_1: 0.153	0.324	0.656
							Z: 0.066	0.231	0.540
May 21, 1986	1313-1321	--	--	6	.00436	--	Z_1:-0.186	0.291	0.752
							Z: 0.066	0.231	0.540
May 21, 1986	1331-1344	--	--	5	.00436	--	Z_1: 0.030	0.165	0.624
							Z: 0.061	0.214	0.499
May 21, 1986	1502-1510	--	--	5	.00436	--	Z_1: 0.073	0.263	0.914
							Z: 0.066	0.231	0.540
May 21, 1986	1522-1531	--	--	5	.00436	--	Z_1: 0.093	0.306	0.607
							Z: 0.066	0.231	0.540
May 21, 1986	1537-1546	--	--	5	.00436	--	Z_1:-0.053	0.317	0.681
							Z: 0.066	0.231	0.540
May 21, 1986	1552-1559	--	--	5	.00436	--	Z_1:-0.025	0.316	0.641
							Z: 0.068	0.239	0.559

Table 1.--Measured and theoretical values of sediment-distribution exponent Z--Continued

Date	Time	Percent of flow at section	Depth (ft)	No. of samples	Slope	Mean velocity (ft/s)	Values of Z for size class 0.062-0.125 mm	0.125-0.250 mm	0.250-0.500 mm
			Toutle River at Tower Road near Silver Lake (14242580)						
June 8, 1982	--	10	1.8	7	0.00276	2.66	Z : 0.149	0.238	--
							Z_1: 0.119	0.351	--
	--	30	1.7	7	.00276	4.47	Z :-0.003	0.098	0.745
							Z_1: 0.123	0.361	0.968
	--	50	1.7	7	.00276	8.18	Z : 0.174	0.377	0.878
							Z_1: 0.123	0.361	0.968
	--	70	1.7	7	.00276	8.36	Z : 0.028	0.375	1.136
							Z_1: 0.123	0.361	0.968
	--	90	1.5	6	.00276	6.63	Z : 0.145	0.286	0.995
							Z_1: 0.130	0.383	1.026
Dec. 3, 1982	1108-1135	--	4.7	6	.00379	--	Z : 0.114	0.269	0.602
							Z_1: 0.056	0.196	0.463
Dec. 3, 1982	1300-1330	--	4.7	5	.00385	--	Z : 0.051	0.173	0.199
							Z_1: 0.055	0.194	0.459
Jan. 7, 1983	1330-1400	--	5.0	8	.00371	11.91	Z : 0.055	0.167	0.306
							Z_1: 0.052	0.185	0.454
Mar. 10, 1983	1120-1200	--	5.0	7	.00314	6.26	Z : 0.056	0.347	0.729
							Z_1: 0.060	0.207	0.492
Nov. 3, 1983	1326-1410	--	7.5	7	.00346	--	Z : 0.055	0.206	0.398
							Z_1: 0.049	0.164	0.396
Nov. 3, 1983	1429-1517	--	13.2	6	.00346	--	Z : 0.071	0.086	0.431
							Z_1: 0.037	0.124	0.299
Nov. 3, 1983	1602-1614	--	3.2	3	.00302	--	Z : 0.063	0.095	0.437
							Z_1: 0.081	0.269	0.649
Nov. 4, 1983	1154-1212	--	7.7	7	.00288	--	Z : 0.180	0.295	0.538
							Z_1: 0.050	0.175	0.415
Nov. 4, 1983	1318-1342	--	8.1	7	.00288	--	Z : 0.064	0.211	0.432
							Z_1: 0.049	0.170	0.404

Table 1.--Measured and theoretical values of sediment-distribution exponent Z--Continued

Date	Time	Percent of flow at section	Depth (ft)	No. of samples	Slope	Mean velocity (ft/s)	Values of Z for size class 0.062-0.125 mm	0.125-0.250 mm	0.250-0.500 mm
Toutle River at Tower Road near Silver Lake (14242580)									
Nov. 17, 1983	1046-1114	--	13.4	7	0.00301	--	Z_1: 0.013	-0.190	0.365
							Z_2: 0.035	0.125	0.307
Nov. 17, 1983	1243-1258	--	14.8	7	.00293	--	Z_1: 0.028	0.155	0.453
							Z_2: 0.034	0.121	0.296
Nov. 2, 1984	1320-1347	--	15.5	9	.00322	--	Z_1:-0.024	0.174	0.561
							Z_2: 0.032	0.105	0.276
Mar. 22, 1985	1235-1245	--	2.7	4	.00239	--	Z_1: 0.236	0.564	1.095
							Z_2: 0.082	0.290	0.739
Mar. 22, 1985	1249-1301	--	2.7	4	.00239	--	Z_1:-0.049	0.354	0.613
							Z_2: 0.082	0.290	0.739
June 7, 1985	1447-1504	--	5.5	5	.00556	--	Z_1: 0.067	-0.075	0.353
							Z_2: 0.045	0.151	0.353
June 7, 1985	1533-1551	--	5.5	6	.00556	--	Z_1: 0.151	0.461	0.690
							Z_2: 0.045	0.151	0.353
June 7, 1985	1613-1625	--	5.5	6	.00556	--	Z_1: 0.115	0.402	0.708
							Z_2: 0.045	0.151	0.353
June 7, 1985	1629-1648	--	5.5	6	.00556	--	Z_1: 0.172	0.442	0.554
							Z_2: 0.045	0.151	0.353
June 7, 1985	1718-1736	--	5.7	6	.00556	--	Z_1: 0.102	0.366	0.645
							Z_2: 0.045	0.148	0.346
June 7, 1985	1826-1838	--	5.3	5	.00556	--	Z_1: 0.091	0.404	0.630
							Z_2: 0.046	0.154	0.359
June 7, 1985	1845-1859	--	5.5	6	.00556	--	Z_1: 0.101	0.279	0.405
							Z_2: 0.045	0.151	0.353

Table 1.--Measured and theoretical values of sediment-distribution exponent Z--Continued

Date	Time	Percent of flow at section	Depth (ft)	No. of samples	Slope	Mean velocity (ft/s)	Values of Z for size class 0.062-0.125 mm	0.125-0.250 mm	0.250-0.500 mm
Toutle River at Highway 99 near Castle Rock (14242690)									
June 22, 1982	--	10	6.3	11	0.00240	4.87	Z_1: 0.089	0.214	0.372
							$\bar{Z}$: 0.064	0.232	0.537
		30	6.6	10	.00240	6.34	Z1: 0.245	0.719	2.348
							Z: 0.063	0.228	0.525
		50	4.6	8	.00240	7.52	Z_1: 0.248	0.536	0.902
							$\bar{Z}$: 0.075	0.272	0.629
		70	2.4	8	.00240	7.42	Z_1: 0.075	0.230	0.234
							$\bar{Z}$: 0.104	0.377	0.871
Cowlitz River at Castle Rock (14243000)									
Jan. 14, 1981	--	10	6.6	5	.00034	4.21	Z_1: 0.146	0.350	0.664
							$\bar{Z}$: 0.148	0.519	1.296
		30	6.5	5	.00034	6.95	Z_1: 0.236	0.740	1.105
							$\bar{Z}$: 0.150	0.523	1.308
		50	6.7	5	.00034	6.84	Z_1: 0.393	0.675	--
							$\bar{Z}$: 0.148	0.519	--
		70	7.6	5	.00034	7.19	Z_1: 0.381	0.888	--
							$\bar{Z}$: 0.139	0.487	--
		90	10.0	5	.00034	5.03	Z_1: 0.186	0.624	0.705
							$\bar{Z}$: 0.121	0.416	1.360
June 30, 1982	--	10	6.6	10	.00050	3.17	Z_1: 0.089	0.629	0.475
							$\bar{Z}$: 0.126	0.447	1.043
		30	7.0	10	.00050	4.25	Z_1: 0.160	0.553	0.762
							$\bar{Z}$: 0.126	0.447	1.043
		50	7.4	10	.00050	4.32	Z_1: 0.073	0.347	0.412
							$\bar{Z}$: 0.123	0.435	1.014
		70	7.8	10	.00050	4.13	Z_1: 0.053	0.335	0.831
							$\bar{Z}$: 0.117	0.414	0.967
		90	8.5	10	.00050	4.10	Z_1: 0.021	0.243	0.349
							$\bar{Z}$: 0.115	0.405	0.946

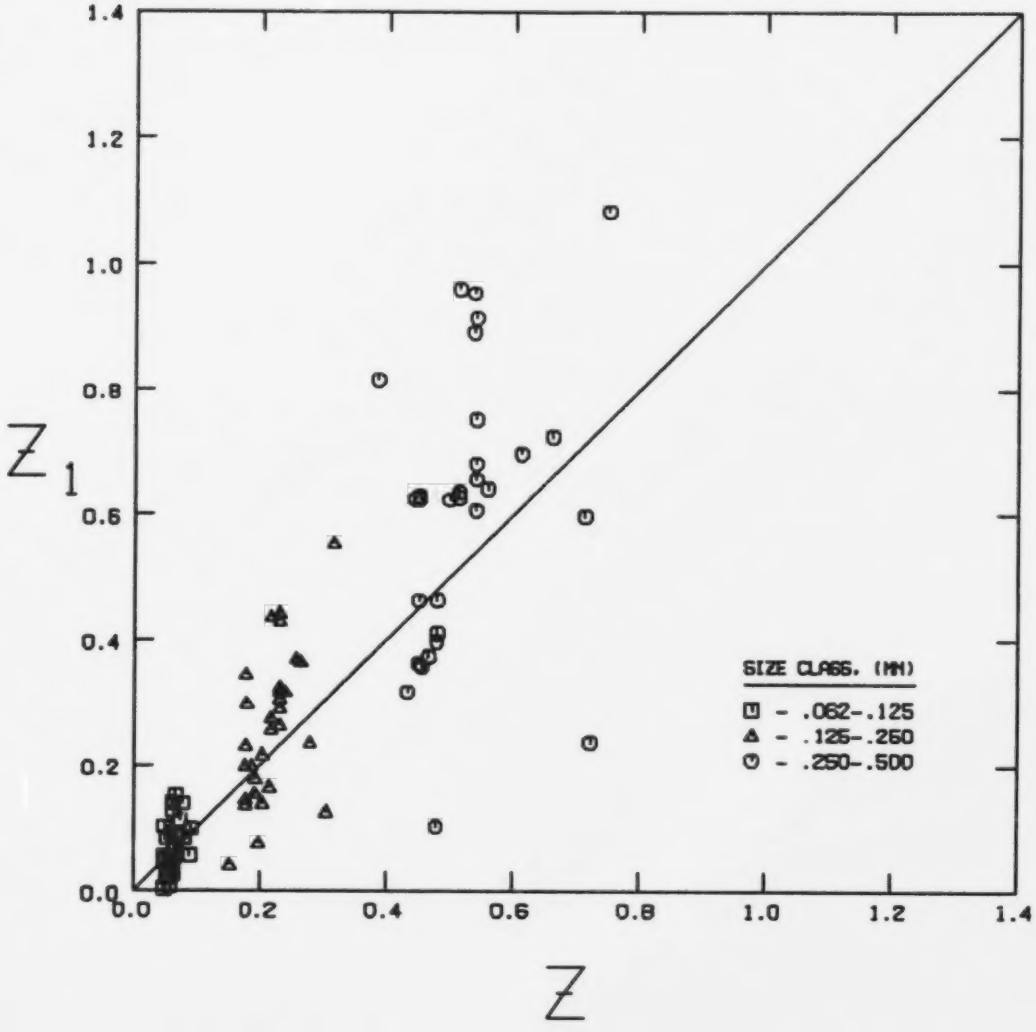

Figure 3.--Plot of measured (Z_1) and theoretical (Z) values of sediment-distribution exponent Z for North Fork Toutle River at Kid Valley, Washington.

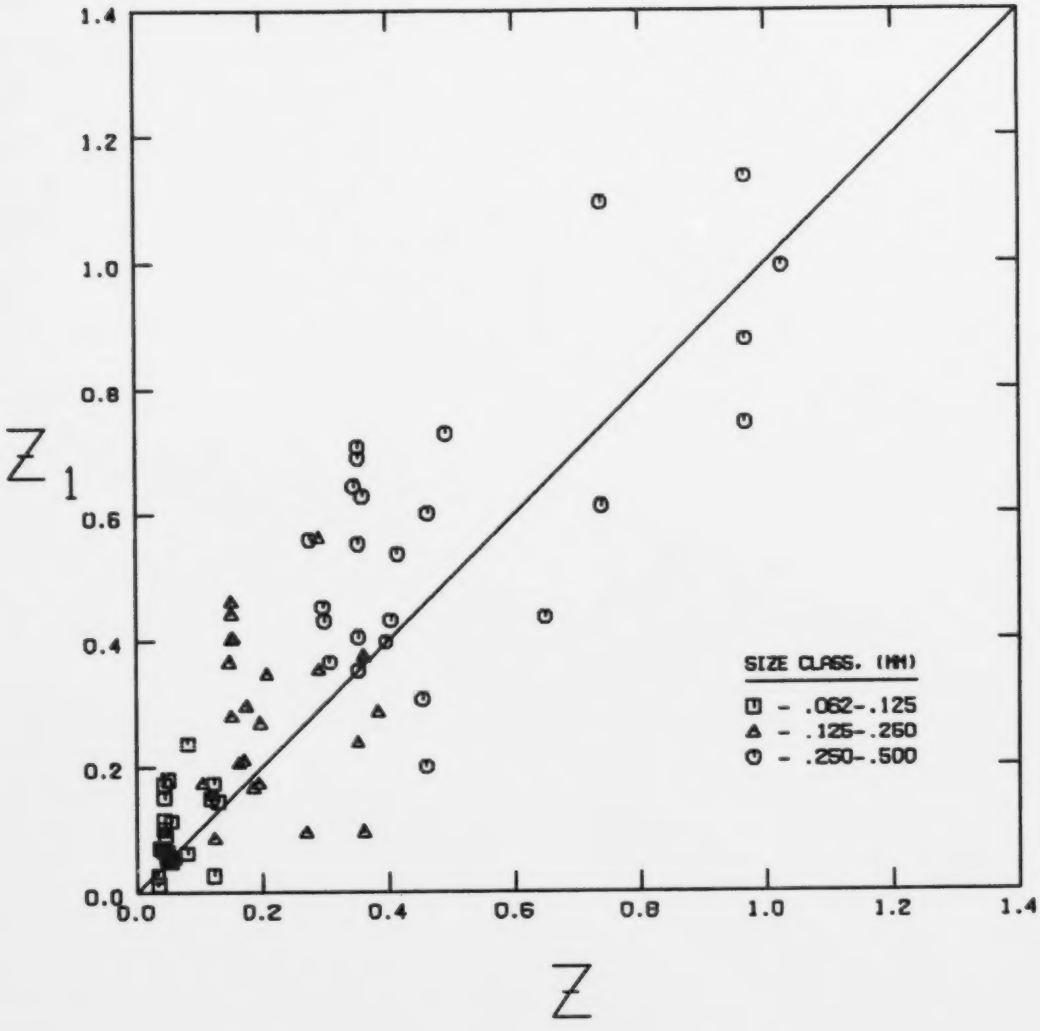

Figure 4.--Plot of measured (Z_1) and theoretical (Z) values of sediment-distribution exponent Z for Toutle River at Tower Road near Silver Lake, Washington.

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14216350 -- Muddy River above Clear Creek near Cougar, WA

LOCATION.--Lat 46°07'03", long 122°00'24", in NW1/4 SE1/4 sec.1, T.7 N., R.6 E., Skamania County, Hydrologic Unit 17080002, Gifford Pinchot National Forest, on right bank 0.25 mi downstream from Forest Service Road 125, approximately 14 mi northeast of Cougar.

DRAINAGE AREA.--84.1 mi^2.

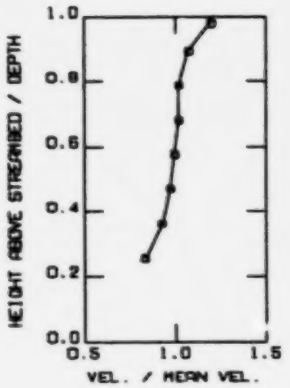
REACH DESCRIPTION.--The Muddy River channel was covered on May 18, 1980 with massive sediment deposits from debris flows and mudflows, and sediment loads are contributed by erosion of the deposits and by bank failures of older, exposed alluvium. Vertical-profile data were collected from the cableway at the gaging station cross section. The sand-bed channel is confined in a narrow reach having bedrock banks that support a dense forest.

14216350 - Muddy River above Clear Creek near Cougar, WA

February 16, 1982 File No.: 1.1

Depth: 4.7 ft
Stream discharge: 5,270 cubic feet per second
Station: 141
Mean velocity: 5.34 ft/s

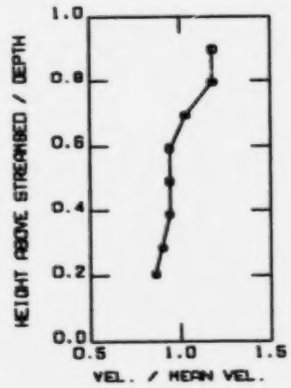
Time	Height above bed (ft)	Velocity (ft/s)
1540	1.2	4.46
1540	1.7	4.96
1540	2.2	5.20
1540	2.7	5.32
1540	3.2	5.45
1540	3.7	5.45
1540	4.2	5.74
1540	4.6	6.41



February 16, 1982 File No.: 1.2

Depth: 4.9 ft
Station: 91
Stream discharge: 5,270 cubic feet per second
Mean velocity: 10.96 ft/s

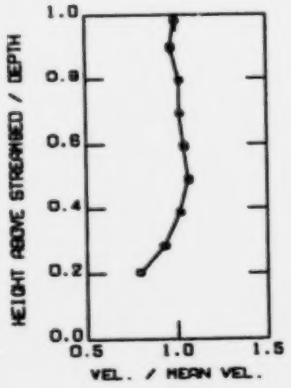
Time	Height above bed (ft)	Velocity (ft/s)
1550	1.0	9.46
1550	1.4	9.89
1550	1.9	10.36
1550	2.4	10.36
1550	2.9	10.36
1550	3.4	11.32
1550	3.9	12.95
1550	4.4	12.95



February 17, 1982 File No.: 2.1

Depth: 4.9 ft
Station: 85
Stream discharge: 4,480 cubic feet per second
Mean velocity: 12.42 ft/s

Time	Height above bed (ft)	Velocity (ft/s)
1610	1.0	9.99
1610	1.4	11.27
1610	1.9	12.65
1610	2.4	12.26
1610	2.9	12.95
1610	3.4	12.65
1610	3.9	12.65
1610	4.4	12.09
1610	4.8	12.36

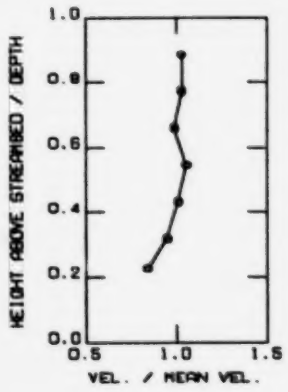


14216350 - Muddy River above Clear Creek near Cougar, WA

February 19, 1982 File No.: 3.1

Depth: 4.4 ft
Station: 85
Mean velocity: 11.44 ft/s
Stream discharge: 3,090 cubic feet per second

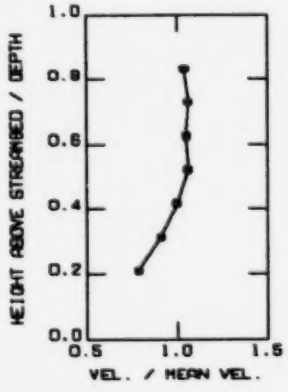
Time	Height above bed (ft)	Velocity (ft/s)
1100	1.0	9.67
1100	1.4	10.88
1100	1.9	11.57
1100	2.4	12.09
1100	2.9	11.33
1100	3.4	11.82
1100	3.9	11.82



February 21, 1982 File No.: 4.1

Depth: 4.8 ft
Station: 113
Mean velocity: 10.88 ft/s
Stream discharge: 4,420 cubic feet per second

Time	Height above bed (ft)	Velocity (ft/s)
1525	1.0	8.54
1525	1.5	9.89
1525	2.0	10.88
1525	2.5	11.57
1525	3.0	11.45
1525	3.5	11.57
1525	4.0	11.33

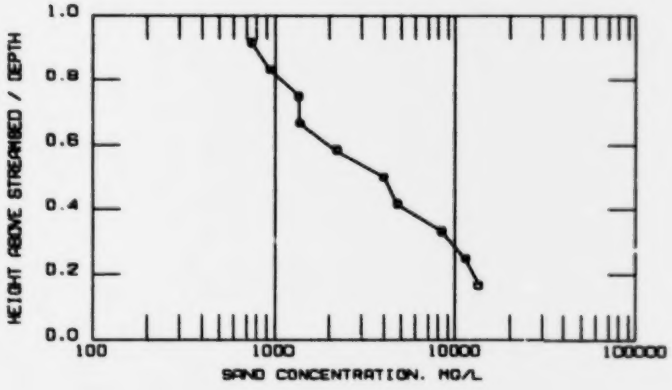


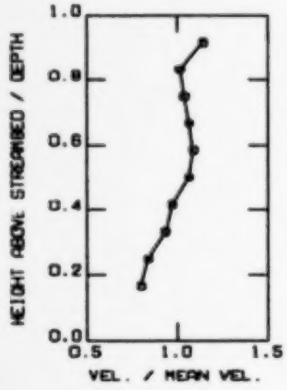
14216350 - Muddy River above Clear Creek near Cougar, WA

February 26, 1982 File No.: 5.1

Depth: 6.0 ft
Station: 150
Water temperature: 5.5 degrees C
Stream discharge: 986 cubic feet per second
Mean velocity: 9.50 ft/s

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Pct finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Concentration, mg/L Coarser than 0.062
1545	1.0	7.60	14000	4	5.00	560	13400
1545	1.5	7.97	11900	5	3.00	595	11300
1545	2.0	8.89	8880	6	2.00	533	8350
1545	2.5	9.26	5290	10	1.40	529	4760
1545	3.0	10.12	4540	12	1.00	545	4000
1545	3.5	10.36	2720	19	0.71	517	2200
1545	4.0	10.12	1880	27	0.50	508	1370
1545	4.5	9.89	1860	27	0.33	502	1360
1545	5.0	9.67	1450	35	0.20	508	942
1545	5.5	10.88	1240	40	0.09	496	744
Z1						0.039	0.824

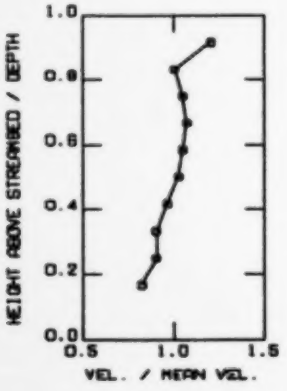




February 26, 1982 File No.: 5.2

Depth: 6.0 ft
Station: 150
Water temperature: 5.5 degrees C
Stream discharge: 986 cubic feet per second
Mean velocity: 9.01 ft/s

Time	Height above bed (ft)	Velocity (ft/s)
1605	1.0	7.43
1605	1.5	8.17
1605	2.0	8.17
1605	2.5	8.71
1605	3.0	9.26
1605	3.5	9.46
1605	4.0	9.67
1605	4.5	9.46
1605	5.0	9.07
1605	5.5	10.88

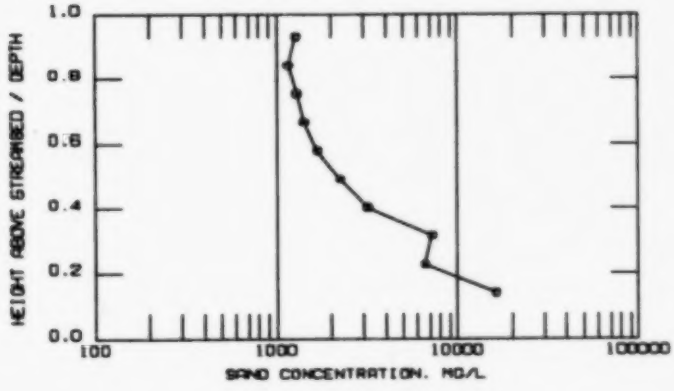


14216350 - Muddy River above Clear Creek near Cougar, WA

March 10, 1982 File No.: 6.1

Depth: 5.7 ft
Water temperature: 7.5 degrees C
Stream discharge: 1,520 cubic feet per second

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Pct finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Concentration, mg/L Coarser than 0.062
1500	0.8	--	16900	4	6.12	676	16200
1500	1.3	--	7140	8	3.38	571	6570
1500	1.8	--	7830	8	2.17	626	7200
1500	2.3	--	3750	15	1.48	562	3190
1500	2.8	--	2790	20	1.04	558	2230
1500	3.3	--	2230	25	0.73	558	1670
1500	3.8	--	1970	28	0.50	552	1420
1500	4.3	--	1850	30	0.33	555	1300
1500	4.8	--	1710	32	0.19	547	1160
1500	5.3	--	1830	30	0.08	549	1280
Z1						0.038	0.608

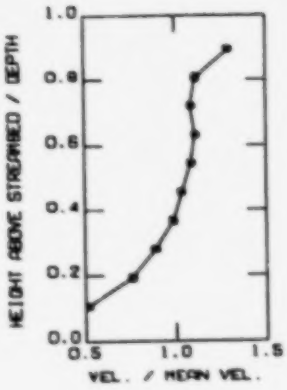


14216350 - Muddy River above Clear Creek near Cougar, WA

March 10, 1982 File No.: 6.2

Depth: 5.7 ft
Station: 147
Water temperature: 7.5 degrees C
Stream discharge: 1,590 cubic feet per second
Mean velocity: 9.76 ft/s
Water-surface slope: 0.00600

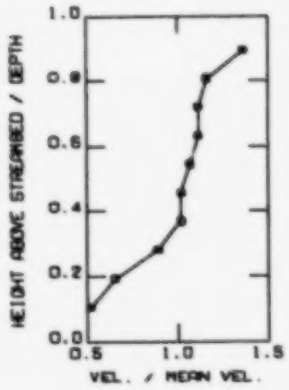
Time	Height above bed (ft)	Velocity (ft/s)
1440	0.6	5.08
1440	1.1	7.43
1440	1.6	8.71
1440	2.1	9.67
1440	2.6	10.12
1440	3.1	10.62
1440	3.6	10.88
1440	4.1	10.62
1440	4.6	10.88
1440	5.1	12.65



March 10, 1982 File No.: 6.3

Depth: 5.7 ft
Station: 147
Water temperature: 7.5 degrees C
Stream discharge: 1,520 cubic feet per second
Mean velocity: 10.16 ft/s
Water-surface slope: 0.00600

Time	Height above bed (ft)	Velocity (ft/s)
1520	0.6	5.32
1520	1.1	6.67
1520	1.6	9.07
1520	2.1	10.36
1520	2.6	10.36
1520	3.1	10.88
1520	3.6	11.33
1520	4.1	11.33
1520	4.6	11.82
1520	5.1	13.88



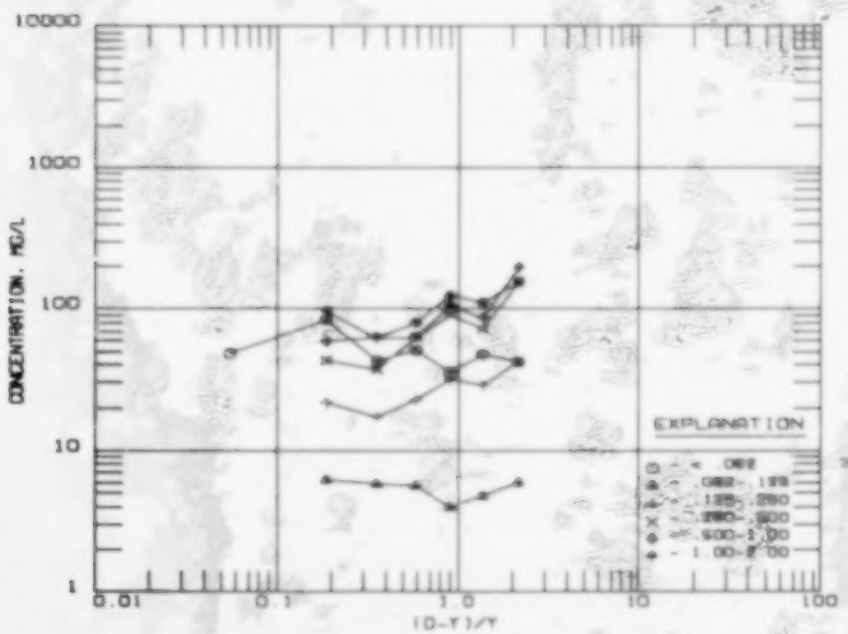
14216350 - Muddy River above Clear Creek near Cougar, WA

July 13, 1982 File No.: 7.1

Depth: 1.9 ft
Station: 146
Water temperature: 12.5 degrees C
Stream discharge: 225 cubic feet per second
Mean velocity: 3.81 ft/s
Water-surface slope: .00600

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1238	0.6	3.80	599	7	8	15	41	67	100
1239	0.8	4.16	479	10	11	17	32	55	73
1240	1.0	4.16	395	9	10	18	41	73	100
1241	1.2	4.07	286	18	20	28	50	78	100
1242	1.4	3.80	290	15	17	23	36	58	79
1243	1.6	3.35	310	27	29	36	50	69	100
1244	1.8	2.86	103	47					

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1238	2.17	42	8	42	156	156	198	557
1239	1.38	48	5	29	72	110	86	431
1240	0.90	36	4	32	91	126	107	359
1241	0.58	51	6	23	63	80	65	235
1242	0.36	44	6	17	38	64	61	246
1243	0.19	84	8	22	43	59	96	226
1244	0.06	48						95
Z1		-0.095	-0.071	0.296	0.511	0.413	0.286	0.570



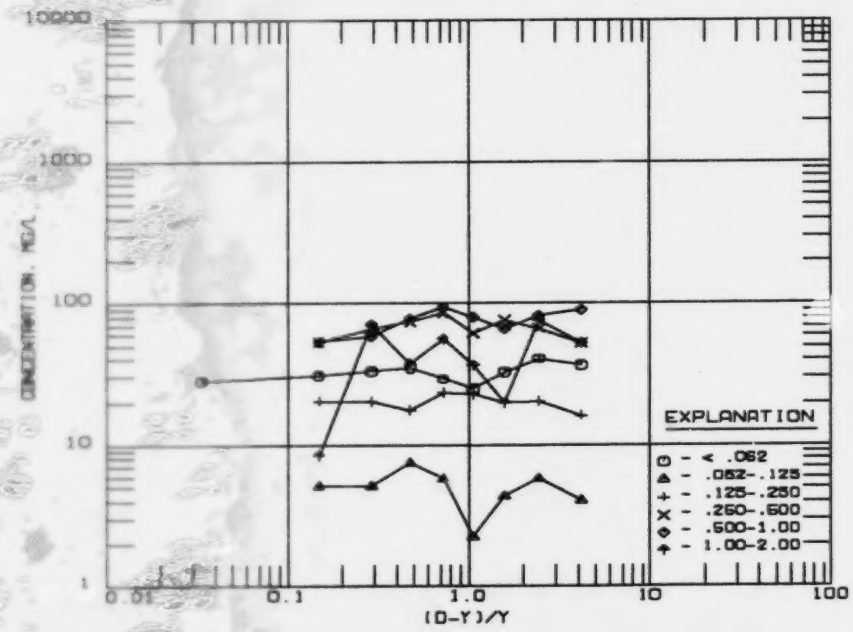
14216350 - Muddy River above Clear Creek near Cougar, WA

July 13, 1982 File No.: 7.2

Depth: 3.1 ft
Station: 350
Water temperature: 12.5 degrees C
Stream discharge: 225 cubic feet per second
Mean velocity: 4.49 ft/s
Water-surface slope: 0.00600

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm					
				0.062	0.125	0.250	0.500	1.00	2.00
1331	0.6	4.26	405	9	10	14	27	49	62
1332	0.9	4.37	291	14	16	23	46	74	100
1334	1.2	4.65	219	15	17	26	61	91	100
1336	1.5	4.65	227	11	12	22	49	84	100
1337	1.8	4.48	293	10	12	20	49	81	100
1339	2.1	4.26	250	14	17	24	54	85	100
1340	2.4	4.37	256	13	15	23	49	72	100
1342	2.7	4.48	171	18	21	33	64	95	100
1343	3.0	5.08	124	23					

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1331	4.17	36	4	16	53	89	53	369
1332	2.44	41	6	20	67	81	76	250
1334	1.58	33	4	20	77	66	20	186
1336	1.07	25	2	23	61	79	36	202
1337	0.72	29	6	23	85	94	56	264
1339	0.48	35	8	18	75	78	38	215
1340	0.29	33	5	20	67	59	72	223
1342	0.15	31	5	21	53	53	9	140
1343	0.03	29						95
Z1		0.044	-0.089	-0.036	-0.001	0.127	0.312	0.225



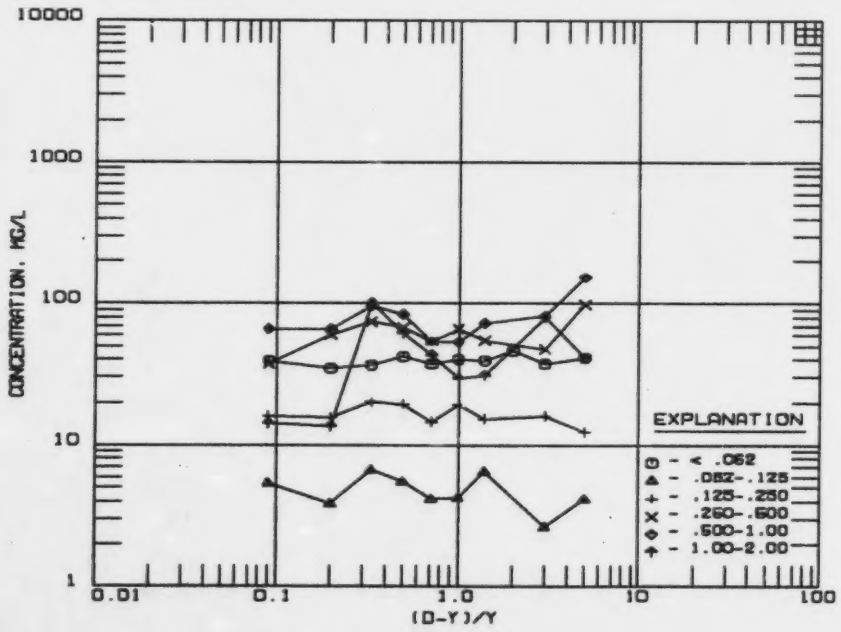
14216350 - Muddy River above Clear Creek near Cougar, WA

July 13, 1982 File No.: 7.3

Depth: 3.6 ft
Station: 153
Water temperature: 12.5 degrees C
Stream discharge: 225 cubic feet per second
Mean velocity: 4.33 ft/s
Water-surface slope: 0.00600

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1403	0.6	4.07	414	10	11	14	38	75	85
1405	0.9	4.16	266	14	15	21	39	70	100
1406	1.2	4.40	201	23					
1408	1.5	4.48	220	18	21	28	53	86	100
1410	1.8	4.37	213	19	21	30	61	86	100
1412	2.1	4.55	208	18	20	27	53	79	100
1413	2.4	4.37	280	15	17	24	48	78	100
1415	2.7	4.26	335	11	13	19	41	70	100
1416	3.0	4.20	194	18	20	28	59	93	100
1418	3.3	4.37	179	22	25	34	55	92	100

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1403	5.00	41	4	12	99	153	41	373
1405	3.00	37	3	16	48	82	80	229
1406	2.00	46						155
1408	1.40	40	7	15	55	73	31	180
1410	1.00	40	4	19	66	53	30	173
1412	0.71	37	4	15	54	54	44	171
1413	0.50	42	6	20	67	84	62	238
1415	0.33	37	7	20	74	97	100	298
1416	0.20	35	4	16	60	66	14	159
1418	0.09	39	5	16	38	66	14	140
Z1		0.027	-0.095	-0.052	0.107	0.121	0.263	0.120



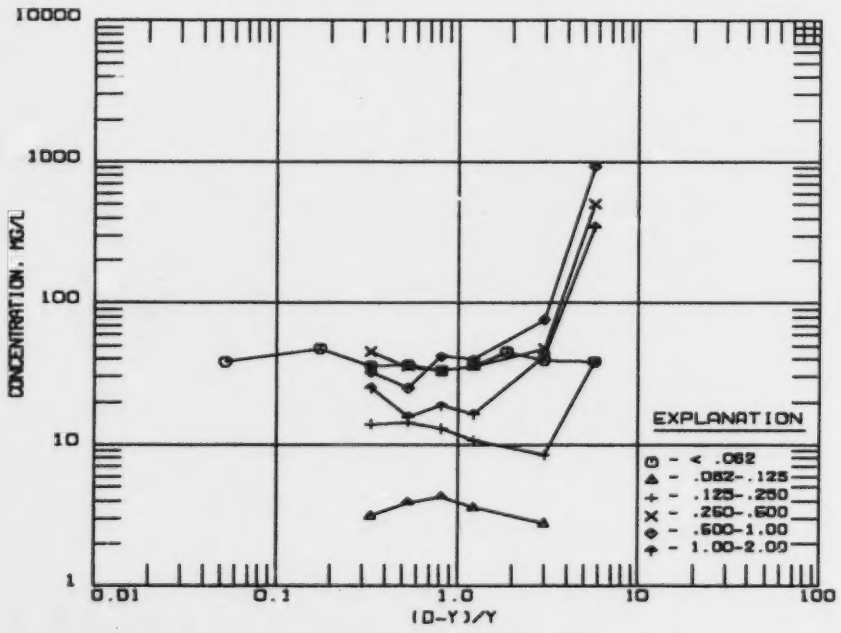
14216350 - Muddy River above Clear Creek near Cougar, WA

July 13, 1982 File No.: 7.4

Depth: 4.0 ft
Station: 156
Water temperature: 12.5 degrees C
Stream discharge: 225 cubic feet per second
Mean velocity: 4.43 ft/s
Water-surface slope: 0.00600

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1434	0.6	3.19	1930	2	2	4	30	78	96
1435	1.0	3.13	282	14	15	18	35	62	77
1436	1.4	4.37	137	33					
1438	1.8	4.37	181	20	22	28	48	70	79
1440	2.2	4.37	144	23	26	35	58	87	100
1441	2.6	4.75	131	28	31	42	69	88	100
1443	3.0	4.85	156	23	25	34	63	84	100
1444	3.4	4.85	104	46					
1444	3.8	6.29	80	48					

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1434	5.67	39		39	502	926	347	1890
1435	3.00	39	3	8	48	76	42	243
1436	1.86	45						92
1438	1.22	36	4	11	36	40	16	145
1440	0.82	33	4	13	33	42	19	111
1441	0.54	37	4	14	35	25	16	94
1443	0.33	36	3	14	45	33	25	120
1444	0.18	48						56
1444	0.05	38						42
Z1		-0.005	-0.077	0.195	0.721	1.070	0.887	0.614

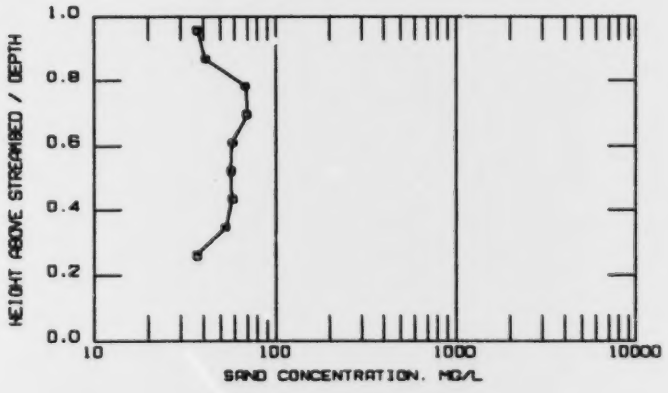


14216350 - Muddy River above Clear Creek near Cougar, WA

July 13, 1982 File No.: 7.5

Depth: 2.3 ft
Station: 160
Water temperature: 12.5 degrees C
Stream discharge: 225 cubic feet per second
Mean velocity: 4.17 ft/s
Water-surface slope: 0.00600

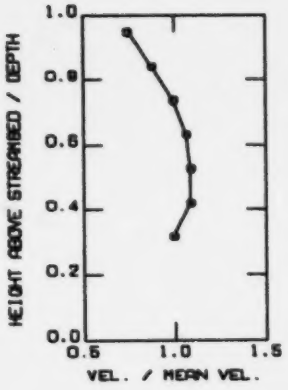
Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Pct finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Concentration, mg/L Coarser than 0.062
1500	0.6	4.37	82	55	2.83	45	37
1501	0.8	4.26	92	42	1.88	39	53
1504	1.0	4.65	109	47	1.30	51	58
1505	1.2	4.07	98	42	0.92	41	57
1506	1.4	4.16	98	41	0.64	40	58
1507	1.6	4.16	114	39	0.44	44	70
1508	1.8	3.98	99	31	0.28	31	68
1510	2.0	3.98	79	48	0.15	38	41
1511	2.2	3.80	65	43	0.05	28	37
Z1						0.110	0.038



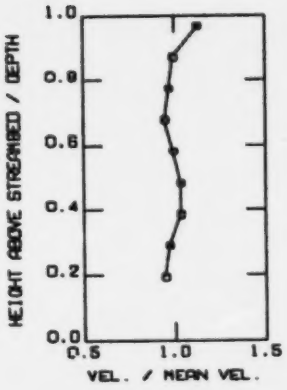
14216350 - Muddy River above Clear Creek near Cougar, WA

July 13, 1982 File Nos.: 7.1 - 7.5

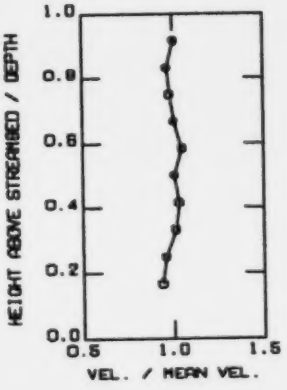
Vertical Profiles



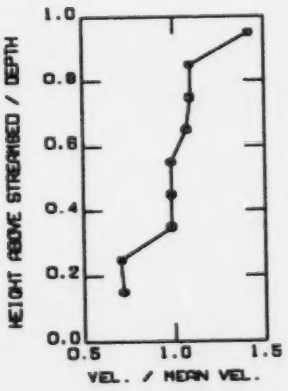
7.1



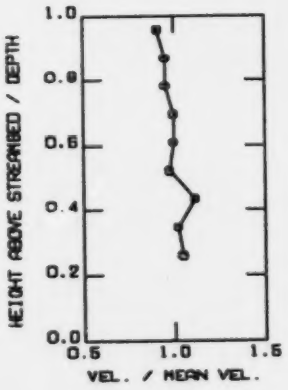
7.2



7.3



7.4



7.5

14240800 Green River above Beaver Creek near Kid Valley, WA

LOCATION.--Lat 46°22'55", long 122°31'21", in SE1/4 NW1/4 sec.2, T.10 N., R.2 E., Cowlitz County, Hydrologic Unit 17080005, on right bank 0.1 mi downstream from logging bridge, 4.5 mi northeast of Kid Valley.

DRAINAGE AREA.--129 mi^2.

REACH DESCRIPTION.--At lower flows, the water-surface profile is controlled by a cobble-boulder riffle 250 feet downstream from the gage, and is increasingly controlled by the channel geometry at higher flows. The channel bottom is principally sand and gravel with some cobble and boulders.

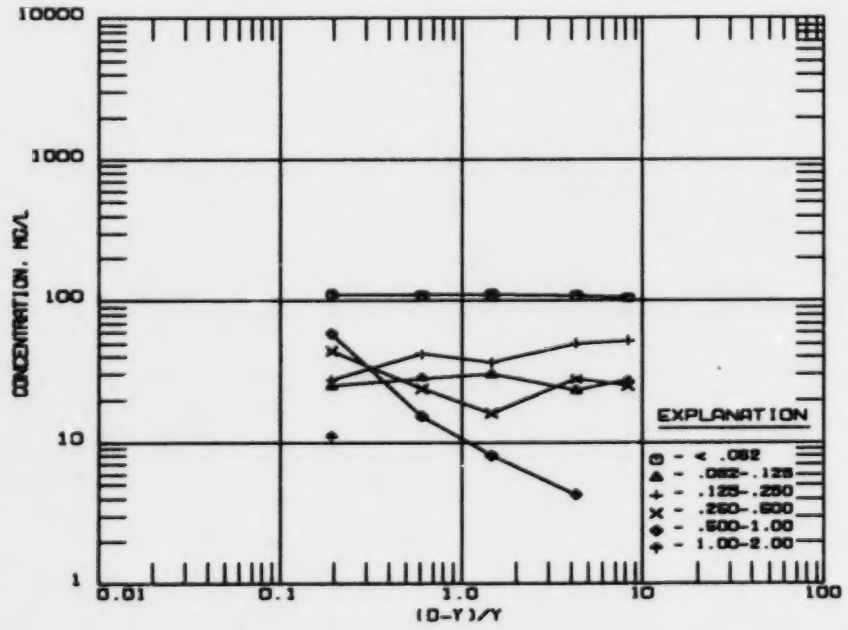
14240800 - Green River above Beaver Creek near Kid Valley, WA

June 17, 1982 File No.: 1.1

Depth: 3.7 ft
Station: 50
Water temperature: 13.0 degrees C
Stream discharge: 687 cubic feet per second

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1620	0.4	--	210	50	63	88	100		
1618	0.7	--	215	51	62	85	98	100	
1616	1.5	--	202	55	70	88	96	100	
1614	2.3	--	220	50	63	82	93	100	
1612	3.1	--	278	40	49	59	75	96	100

Time	(D-Y)/Y	Concentration, in mg/L, of size class, in mm: Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1620	8.25	105	27	52	25			105
1618	4.29	110	24	49	28	4		105
1616	1.47	111	30	36	16	8		91
1614	0.61	110	29	42	24	15		110
1612	0.19	111	25	28	44	58	11	167
Z1		-0.012	-0.002	0.155	-0.111	-0.836		-0.107



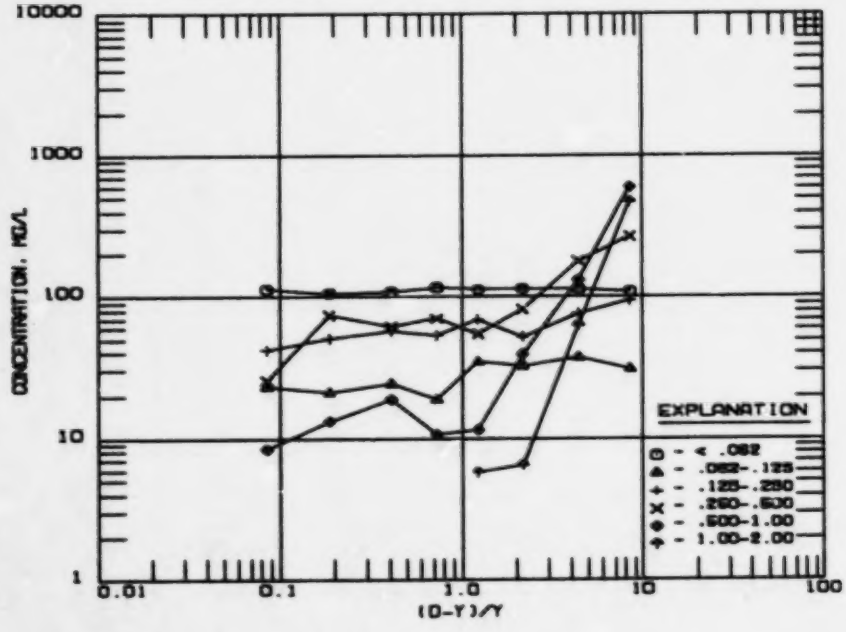
14240800 - Green River above Beaver Creek near Kid Valley, WA

June 17, 1982 File No.: 1.2

Depth: 3.8 ft
Station: 58
Water temperature: 13.0 degrees C
Stream discharge: 687 cubic feet per second

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1603	0.4	--	1560	7	9	15	32	70	100
1558	0.7	--	631	18	24	36	64	85	95
1557	1.2	--	326	35	45	61	86	98	100
1556	1.7	--	289	39	51	75	94	98	100
1555	2.2	--	270	43	50	70	96	100	
1554	2.7	--	271	40	49	70	93	100	
1554	3.2	--	267	40	48	67	95	100	
1553	3.5	--	213	53	64	84	96	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1603	8.50	109	31	94	265	593	468	1450
1558	4.43	114	38	76	177	133	63	517
1557	2.17	114	33	52	82	39	7	212
1556	1.24	113	35	69	55	12	6	176
1555	0.73	116	19	54	70	11		154
1554	0.41	108	24	57	62	19		163
1554	0.19	107	21	51	75	13		160
1553	0.09	113	23	43	26	9		100
Z1		0.003	0.115	0.142	0.401	0.807	2.404	0.476



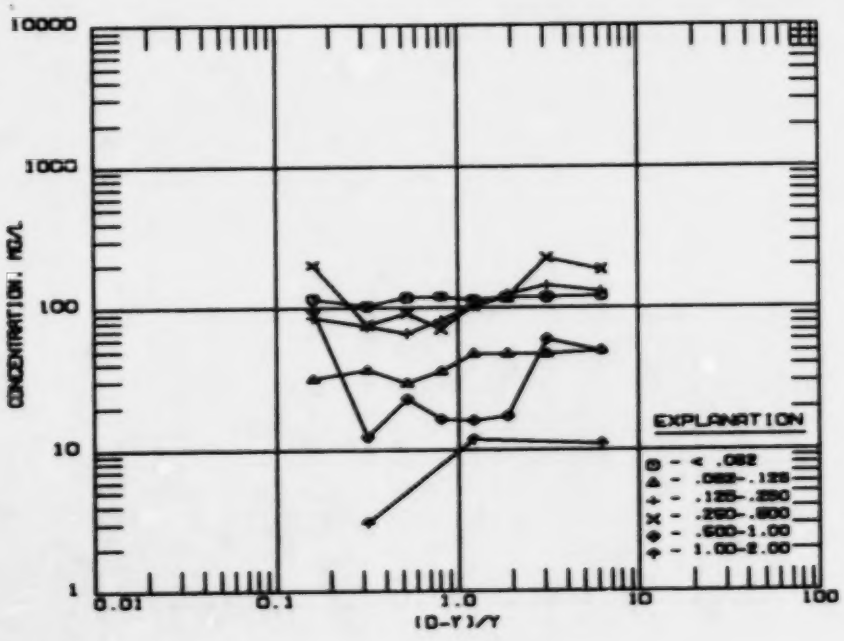
14240800 - Green River above Beaver Creek near Kid Valley, MA

June 17, 1982 File No.: 1.3

Depth: 2.9 ft
Station: 68
Water temperature: 13.0 degrees C
Stream discharge: 687 cubic feet per second

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1541	0.4	--	550	22	31	55	89	98	100
1541	0.7	--	599	20	28	52	90	100	
1540	1.0	--	429	28	39	68	96	100	
1538	1.3	--	397	29	41	67	93	97	100
1537	1.6	--	326	37	48	73	95	100	
1537	1.9	--	329	36	45	65	93	100	
1535	2.2	--	307	34	46	70	95	99	100
1533	2.5	--	534	22	28	44	82	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1541	6.25	121	50	132	187	50	11	429
1541	3.14	120	48	144	228	(?)		479
1540	1.90	120	47	124	120	17		309
1538	1.23	115	48	103	103	16	12	282
1537	0.81	121	36	82	72	16		205
1537	0.53	118	30	66	92	23		211
1535	0.32	104	37	74	77	12	3	203
1533	0.16	117	32	85	203	96		417
Z1		0.021	0.142	0.197	0.131	0.039	0.413	0.132



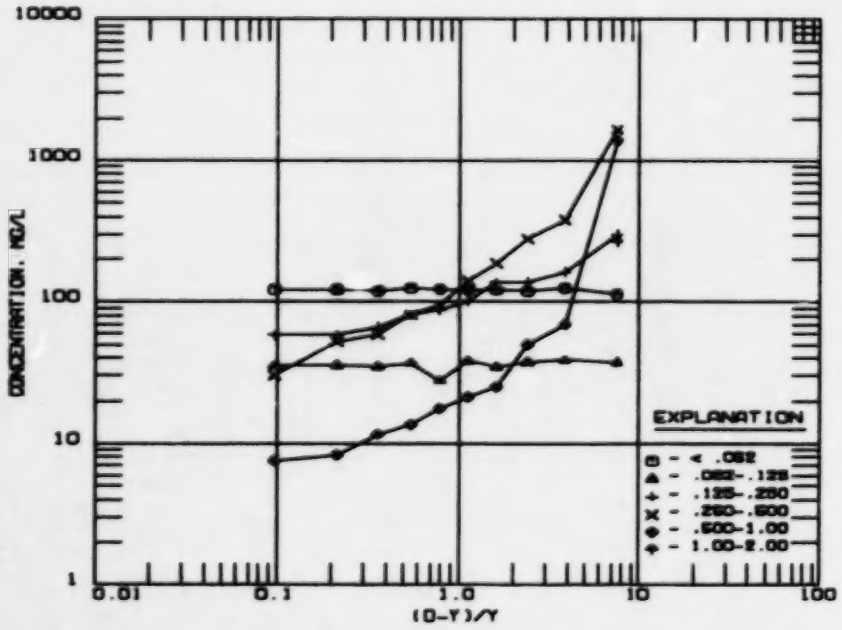
14240800 - Green River above Beaver Creek near Kid Valley, WA

June 17, 1982 File No.: 1.4

Depth: 3.4 ft
Station: 78
Water temperature: 13.0 degrees C
Stream discharge: 687 cubic feet per second

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1521	0.4	—	3780	3	4	12	56	93	100
1520	0.7	—	778	16	21	42	91	100	
1519	1.0	—	626	19	25	47	92	100	
1518	1.3	—	504	24	31	58	95	100	
1517	1.6	—	423	29	38	62	95	100	
1516	1.9	—	349	35	43	68	95	100	
1515	2.2	—	337	37	48	72	96	100	
1514	2.5	—	291	41	53	76	96	100	
1512	2.8	—	277	44	57	78	97	100	
1510	3.1	—	253	48	62	85	97	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1521	7.50	113	38	302	1660	1400	265	3670
1520	3.86	124	39	163	381	70		654
1519	2.40	119	38	138	282	50		507
1518	1.62	121	35	136	186	25		383
1517	1.13	123	38	102	140	21		300
1516	0.79	122	28	87	94	17		227
1515	0.55	125	37	81	81	13		212
1514	0.36	119	35	67	58	12		172
1512	0.21	122	36	58	53	8		155
1510	0.10	121	35	58	30	8		132
Z1		-0.008	0.021	0.374	0.838	0.991		0.657



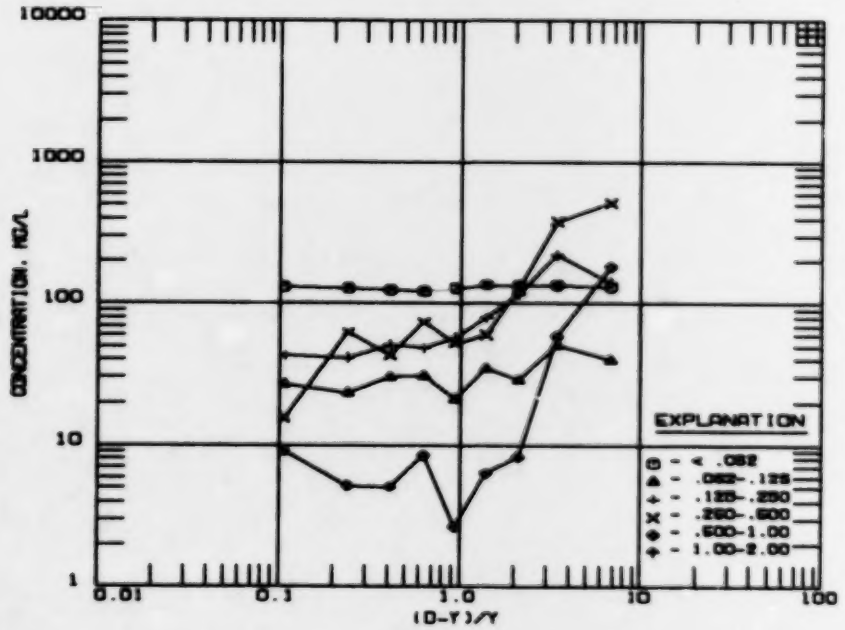
14260800 - Green River above Beaver Creek near Kid Valley, WA

June 17, 1982 File No.: 1.5

Depth: 3.1 ft
Station: 92
Water temperature: 13.0 degrees C
Stream discharge: 687 cubic feet per second

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1456	0.4	--	1010	13	17	31	82	100	
1454	0.7	--	846	16	22	48	93	100	
1452	1.0	--	416	32	39	67	98	100	
1450	1.3	--	316	43	54	79	98	100	
1442	1.6	--	264	49	57	79	99	100	
1437	1.9	--	283	43	54	71	97	100	
1435	2.2	--	255	49	61	81	98	100	
1433	2.5	--	260	49	58	74	98	100	
1432	2.8	--	225	58	70	89	96	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1456	6.75	131	40	141	515	182		879
1454	3.43	135	51	220	381	59		711
1452	2.10	133	29	116	129	8		283
1450	1.38	136	35	79	60	6		180
1442	0.94	129	21	58	53	3		135
1437	0.63	122	31	48	74	8		161
1435	0.41	125	31	51	43	5		130
1433	0.24	127	23	42	62	5		133
1432	0.11	130	27	43	16	9		94
Z1		0.014	0.134	0.402	0.755	0.688		0.541



14241100 -- North Fork Toutle River at Kid Valley, WA

LOCATION.--Lat 46°21'55", long 122°37'40", in NE1/4 SW1/4 sec.12, T.10 N., R.1 E., Cowlitz County, Hydrologic Unit 17080005, on right bank at downstream side of bridge on State Highway 504, 0.8 mi southwest of Kid Valley, and 6.9 mi upstream from confluence with South Fork.

DRAINAGE AREA.--284 mi^2.

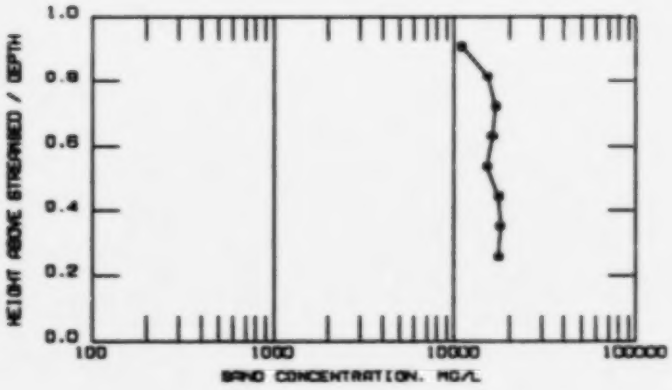
REACH DESCRIPTION.-- The volcanic blast and debris avalanche from the eruption of Mount St. Helens inundated the upper portion of the North Fork Toutle River with sediment on May 18, 1980. As a result, sediment yields at this station have increased from the pre-eruption levels. Vertical-profile data were collected at the cableway in 1982 and 1986, which is 660 feet downstream from the gaging station. The channel has sand-and-gravel banks and streambed.

14241100 - North Fork Toutle River at Kid Valley, WA

February 16, 1982 File No.: 1.1

Depth: 5.4 ft
Station: 127
Water temperature: 7.2 degrees C
Stream discharge: 9,220 cubic feet per second

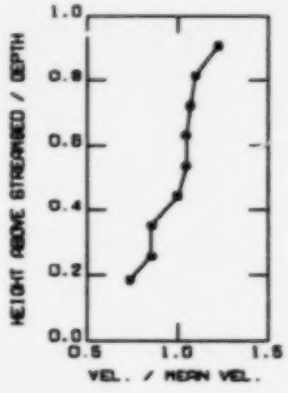
Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Coarser than 0.062
1322	1.4	--	41400	58	2.86	24000	17400
1317	1.9	--	42500	58	1.84	24600	17800
1310	2.4	--	41600	58	1.25	24100	17500
1307	2.9	--	38600	61	0.86	23500	15100
1258	3.4	--	39300	59	0.59	23200	16100
1255	3.9	--	40000	58	0.38	23200	16800
1253	4.4	--	38100	60	0.23	22900	15200
1249	4.9	--	34100	68	0.10	23200	10900
Z1						0.019	0.117



February 16, 1982 File No.: 1.2

Depth: 5.4 ft
Station: 127
Water temperature: 7.2 degrees C
Stream discharge: 9,220 cubic feet per second
Mean velocity: 11.81 ft/s
Water-surface slope: 0.00321

Time	Height above bed (ft)	Velocity (ft/s)
1223	1.0	8.71
1223	1.4	10.12
1223	1.9	10.12
1223	2.4	11.82
1223	2.9	12.20
1223	3.4	12.36
1223	3.9	12.65
1223	4.4	12.95
1223	4.9	14.50



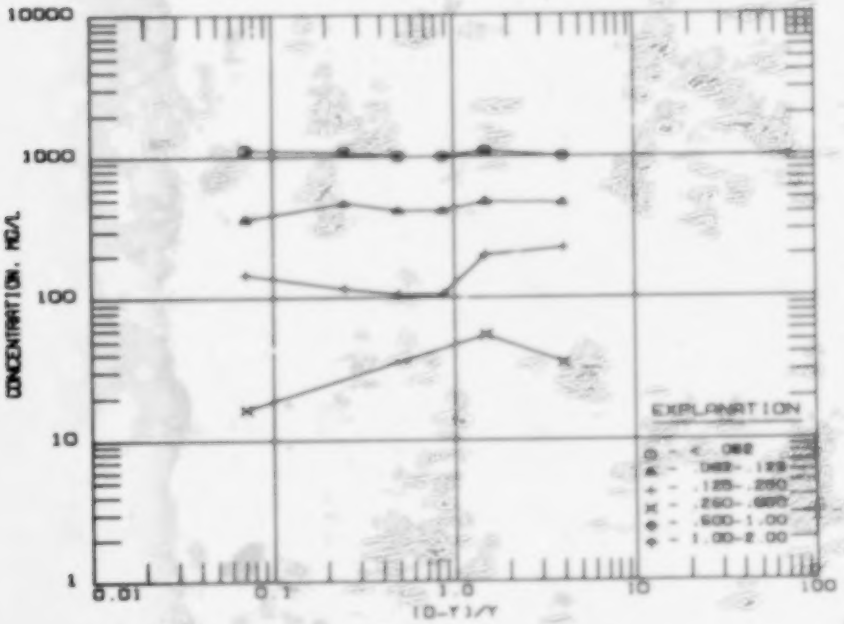
14241100 - North Fork Toutle River at Kid Valley, WA

June 7, 1982 File No.: 2.1

Depth: 1.5 ft
Station: 59
Water temperature: 10.0 degrees C
Stream discharge: 834 cubic feet per second
Mean velocity: 5.52 ft/s
Water-surface slope: 0.00483

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1422	0.3	--	1740	58	85	98	100		
1421	0.6	4.55	1840	60	86	97	100		
1419	0.8	5.28	1530	66	93	100			
1417	1.0	5.45	1530	66	93	100			
1415	1.2	5.45	1660	65	93	100			
1413	1.4	7.26	1640	68	90	99	100		

Time	(D-Y)/Y	Concentration, in mg/L, of size class, in mm: Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1422	4.00	1010	470	226	35			731
1421	1.50	1100	478	202	55			736
1419	0.88	1010	413	107				520
1417	0.50	1010	413	107				520
1415	0.25	1080	465	116				581
1413	0.07	1120	361	148	16			525
Z1		-0.019	0.057	0.126	0.237			0.085



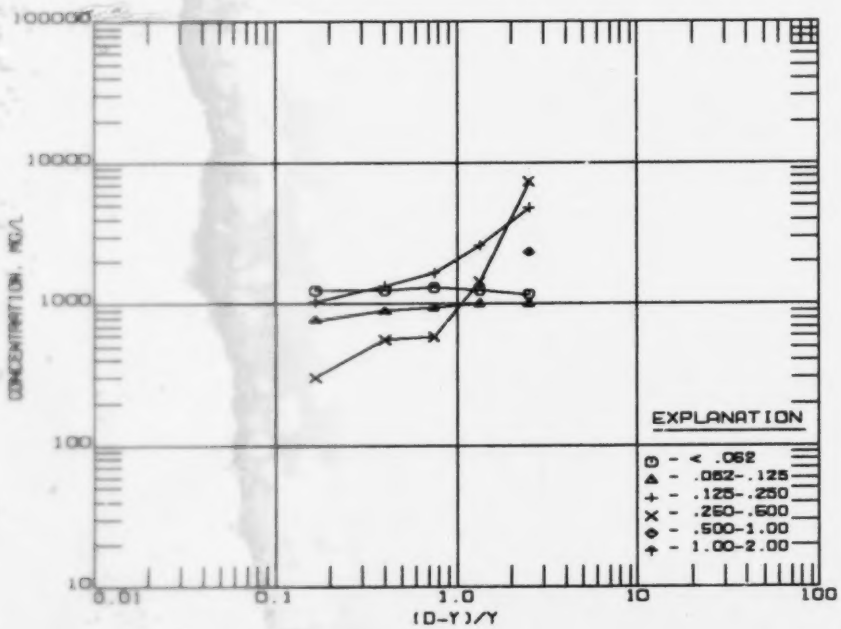
14241100 - North Fork Toutle River at Kid Valley, WA

June 7, 1982 File No.: 2.2

Depth: 1.4 ft
Station: 80 ft
Water temperature: 10.0 degrees C
Stream discharge: 834 cubic feet per second
Mean velocity: 6.58 ft/s
Water-surface slope: 0.00483

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1437	0.4	--	16700	7	13	42	86	100	
1434	0.6	6.06	6290	20	36	77	100		
1433	0.8	6.17	4520	29	50	87	100		
1432	1.0	6.54	4040	31	53	86	100		
1431	1.2	7.97	3350	37	60	91	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1437	2.50	1170	1000	4840	7350	2340		15500
1434	1.33	1260	1010	2580	1450			5030
1433	0.75	1310	949	1670	588			3210
1432	0.40	1250	889	1330	566			2790
1431	0.17	1240	770	1040	302			2110
Z1		-0.015	0.100	0.554	1.083			0.675



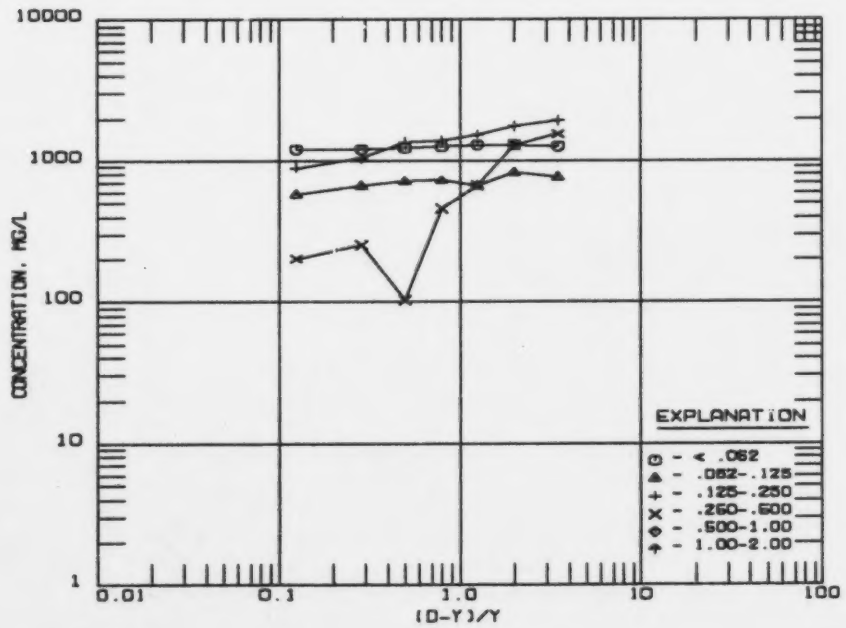
14241100 - North Fork Toutle River at Kid Valley, WA

June 7, 1982 File No.: 2.3

Depth: 1.8 ft
Station: 172
Water temperature: 10.0 degrees C
Stream discharge: 834 cubic feet per second
Mean velocity: 5.30 ft/s
Water-surface slope: 0.00483

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1503	0.4	--	5530	23	37	72	100		
1500	0.6	4.65	5220	25	41	75	100		
1456	0.8	4.75	4180	31	47	84	100		
1454	1.0	5.45	3830	33	52	88	100		
1452	1.2	5.74	3420	36	57	97	100		
1450	1.4	5.95	3200	38	59	92	100		
1448	1.6	6.54	2900	42	62	93	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1503	3.50	1270	774	1940	1550			4260
1500	2.00	1300	835	1770	1300			3920
1456	1.25	1300	669	1550	669			2880
1454	0.80	1260	728	1380	460			2570
1452	0.50	1230	718	1370	103			2190
1450	0.29	1220	672	1060	256			1980
1448	0.12	1220	580	899	203			1680
Z1		0.021	0.085	0.235	0.724			0.294



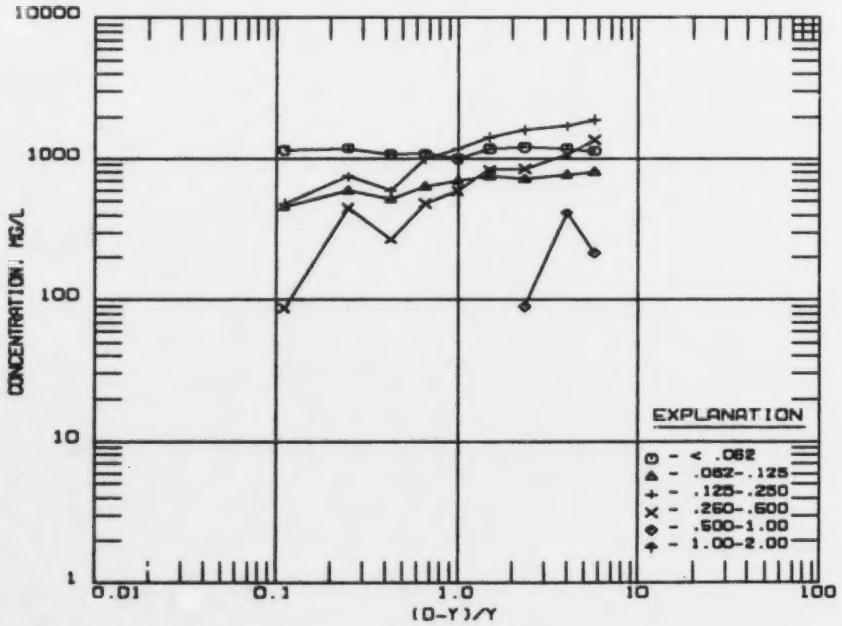
14241100 - North Fork Toutle River at Kid Valley, WA

June 7, 1982 File No.: 2.4

Depth: 2.0 ft
Station: 184
Water temperature: 10.0 degrees C
Stream discharge: 834 cubic feet per second
Mean velocity: 8.20 ft/s
Water-surface slope: 0.00483

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1527	0.3	--	5420	21	36	71	96	100	
1526	0.4	--	5160	23	38	71	92	100	
1524	0.6	6.41	4490	27	43	79	98	100	
1522	0.8	7.43	4190	28	46	80	100		
1520	1.0	7.78	3480	29	49	83	100		
1518	1.2	7.78	3200	34	54	85	100		
1516	1.4	7.60	2450	44	65	89	100		
1514	1.6	10.12	2980	40	60	85	100		
1514	1.8	10.62	2190	53	74	96	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1527	5.67	1140	813	1900	1360	217		4280
1526	4.00	1190	774	1700	1080	413		3970
1524	2.33	1210	718	1620	853	90		3280
1522	1.50	1170	754	1420	838			3020
1520	1.00	1010	696	1180	592			2470
1518	0.67	1090	640	992	480			2110
1516	0.43	1080	514	588	270			1370
1514	0.25	1190	596	745	447			1790
1514	0.11	1160	460	482	88			1030
Z1		0.006	0.139	0.365	0.597	1.151		0.361



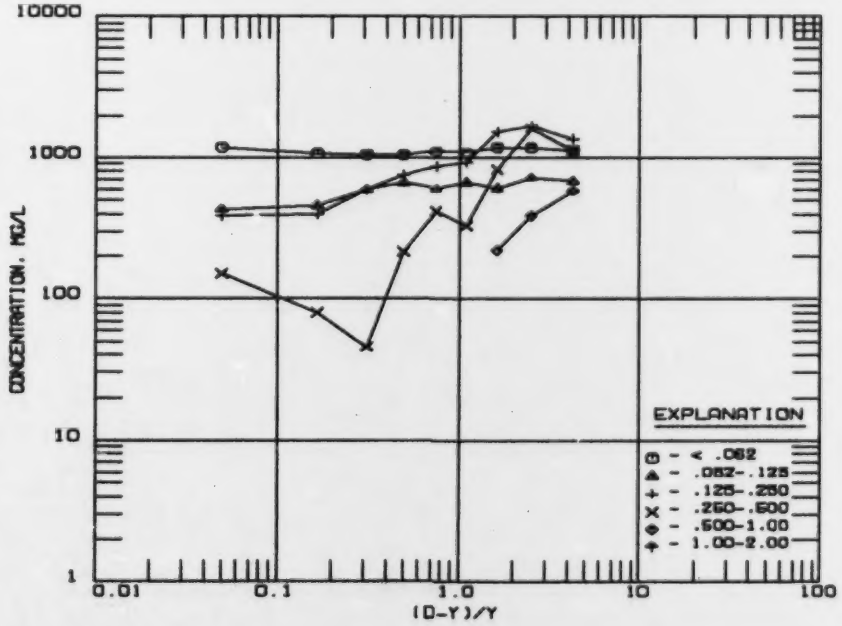
14241100 - North Fork Toutle River at Kid Valley, WA

June 7, 1982 File No.: 2.5

Depth: 2.1 ft
Station: 196
Water temperature: 10.0 degrees C
Stream discharge: 834 cubic feet per second
Mean velocity: 7.23 ft/s
Water-surface slope: 0.00483

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1553	0.4	--	4890	23	37	65	88	100	
1551	0.6	5.20	5590	21	34	64	93	100	
1549	0.8	5.74	4380	27	41	76	95	100	
1547	1.0	6.41	3020	36	58	89	100		
1545	1.2	6.96	3010	37	57	86	100		
1543	1.4	7.43	2690	39	64	92	100		
1542	1.6	7.60	2290	46	72	98	100		
1541	1.8	9.26	2010	53	76	96	100		
1540	2.0	9.26	2160	55	75	93	100		

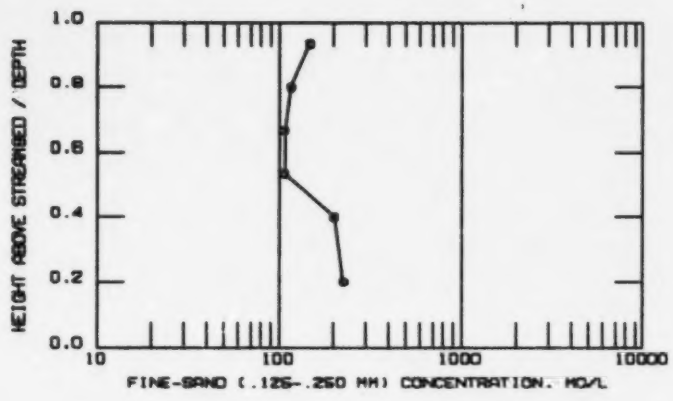
		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1553	4.25	1120	685	1370	1120	587		3770
1551	2.50	1170	727	1680	1620	391		4420
1549	1.62	1180	613	1530	832	219		3200
1547	1.10	1090	664	936	332			1930
1545	0.75	1110	602	873	421			1900
1543	0.50	1050	672	753	215			1640
1542	0.31	1050	595	595	46			1240
1541	0.17	1070	462	402	80			945
1540	0.05	1190	432	389	151			972
Z1		0.005	0.113	0.369	0.697	1.015		0.382

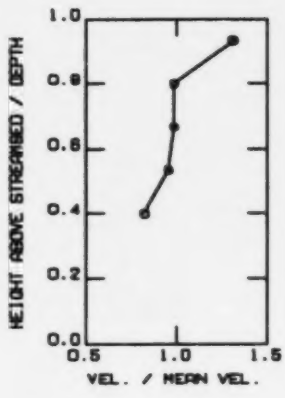


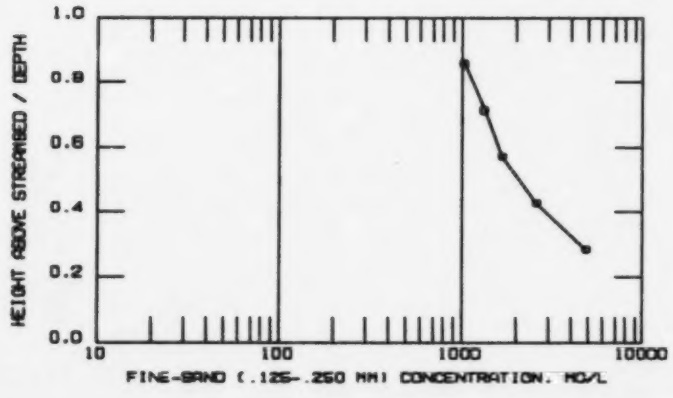
14241100 - North Fork Toutle River at Kid Valley, WA

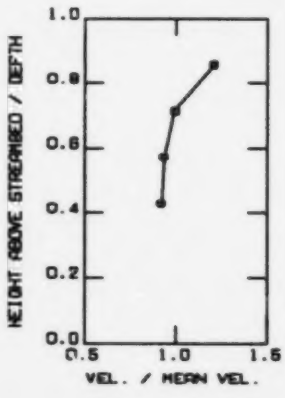
June 7, 1982 File Nos. 2.1 - 2.3

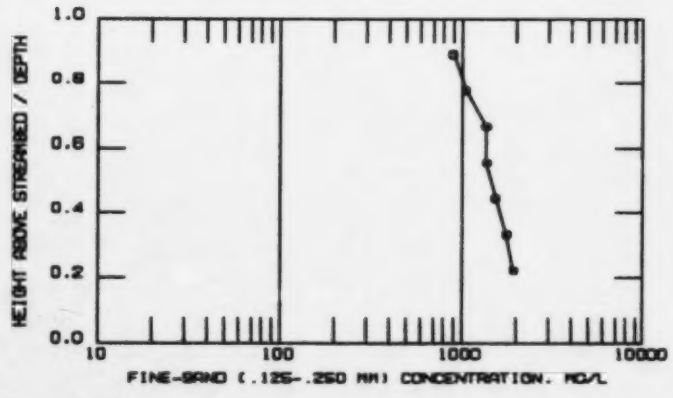
Suspended fine-sand profiles and velocity profiles

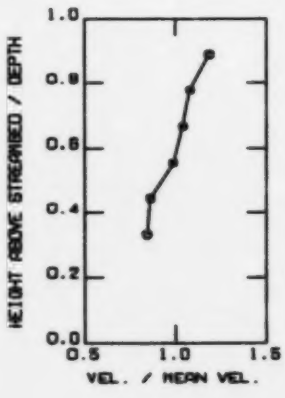








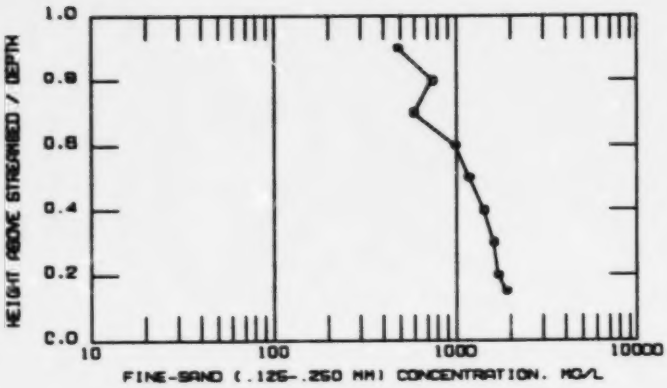


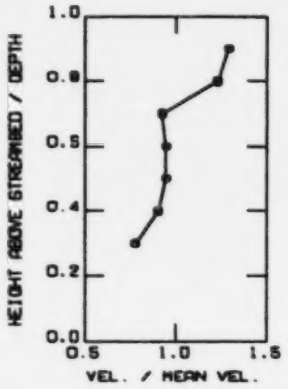


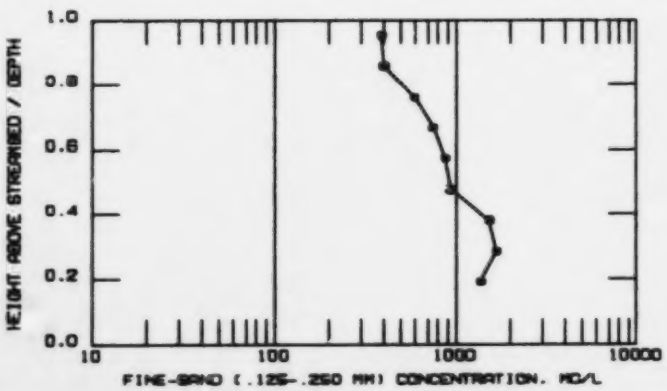
14241100 - North Fork Toutle River at Kid Valley, WA

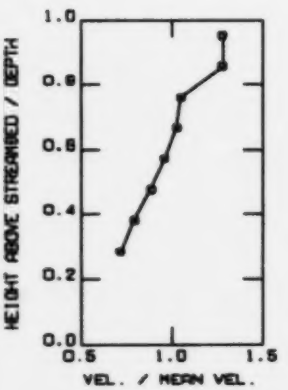
June 7, 1982 File Nos. 2.4 - 2.5

Suspended fine-sand profiles and velocity profiles









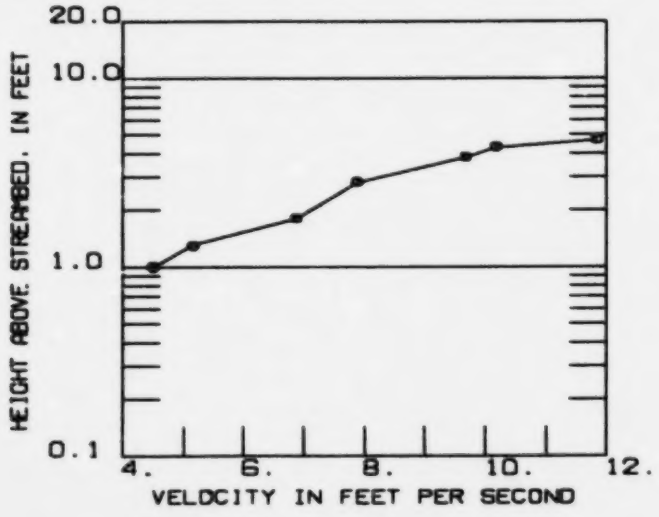
14241100 - North Fork Toutle River at Kid Valley, WA

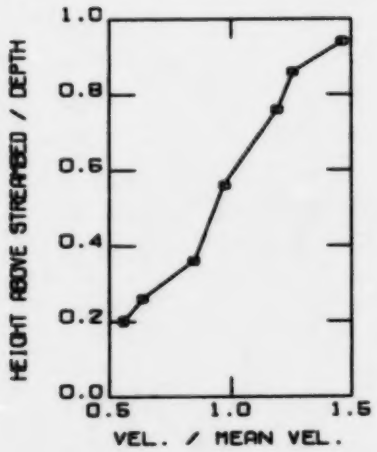
January 30, 1986 File No.: 3.1

Depth: 5.0 ft
Stream Discharge: 1,660 cubic feet per second
Mean velocity: 8.10 ft/s
Water-surface slope: 0.00499

Time	Height above bed (ft)	Velocity (ft/s)	Time Span (min:sec)
1500	1.0	4.50	6:29
1500	1.3	5.15	5:40
1500	1.8	6.87	4:14
1500	2.8	7.88	3:41
1500	3.8	9.67	3:00
1500	4.3	10.18	2:51
1500	4.7	11.84	2:27

This velocity profile was measured over a longer time span than the standard 20 to 40 seconds used for the other profiles presented in this report. At least 800 revolutions were counted by the Price AA current meter before the velocity was read for the interval. The results are graphed below.





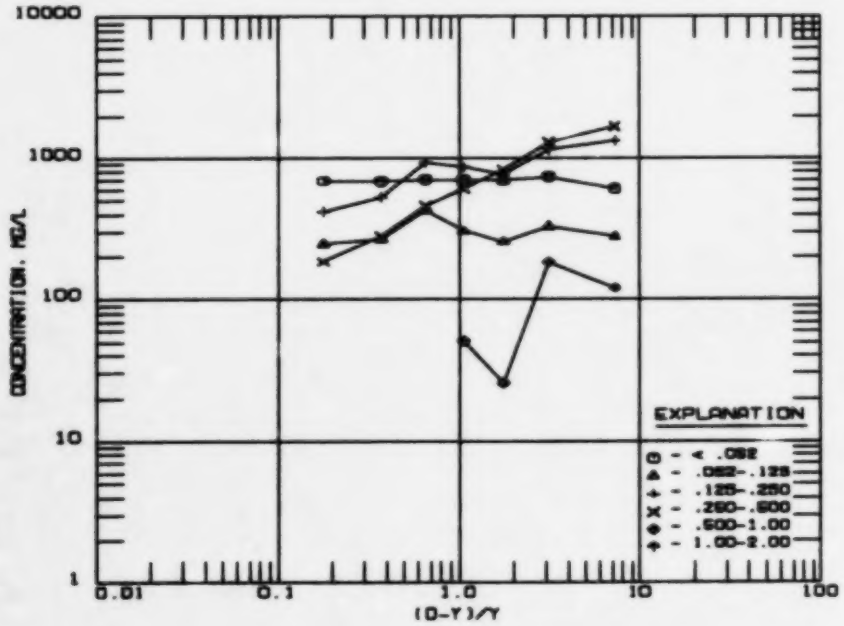
14241100 - North Fork Toutle River at Kid Valley, WA

February 12, 1986 File No.: 4.1

Depth: 3.3 ft
Water temperature: 5.2 degrees C
Stream discharge: 914 cubic feet per second
Water-surface slope: 0.00500

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1255	0.4	—	4020	15	22	55	97	100	
1300	0.8	—	3690	20	29	60	95	100	
1303	1.2	—	2570	27	37	67	99	100	
1306	1.6	—	2530	28	40	74	98	100	
1312	2.0	—	2530	28	45	82	100		
1315	2.4	—	1760	39	54	84	100		
1318	2.8	—	1540	45	61	88	100		

Time	(D-Y)/Y	Concentration, in mg/L, of size class, in mm: Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1255	7.25	603	281	1330	1690	121		3420
1300	3.13	738	332	1140	1290	184		2950
1303	1.75	694	257	771	822	26		1880
1306	1.06	708	304	860	607	51		1820
1312	0.65	708	430	936	455			1820
1315	0.37	686	264	528	282			1070
1318	0.18	693	246	416	185			847
Z1		-0.021	0.023	0.298	0.625	0.699		0.382



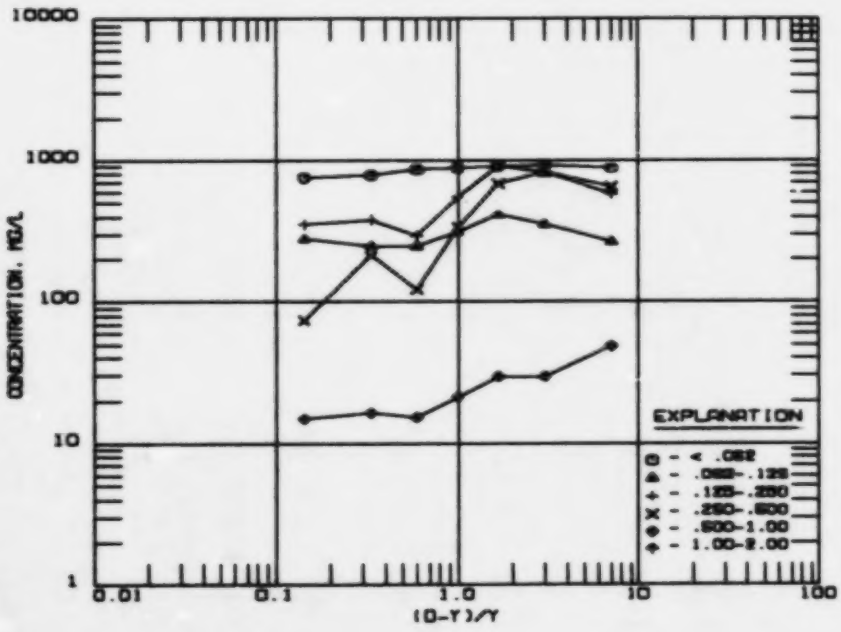
14241100 - North Fork Toutle River at Kid Valley, WA

February 14, 1986 File No.: 5.1

Depth: 3.2 ft
Water temperature: 3.5 degrees C
Stream discharge: 894 cubic feet per second
Water-surface slope: 0.00500

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1217	0.4	—	2440	36	47	71	98	100	
1221	0.8	—	2970	31	43	71	99	100	
1226	1.2	—	2950	31	45	76	99	100	
1229	1.6	—	2110	42	57	83	99	100	
1231	2.0	—	1540	56	72	91	99	100	
1234	2.4	—	1640	48	63	86	99	100	
1237	2.8	—	1480	51	70	94	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1217	7.00	878	268	586	659	49		1560
1221	3.00	921	396	832	832	30		2050
1226	1.67	914	413	914	678	30		2040
1229	1.00	886	316	549	338	21		1220
1231	0.60	862	246	293	123	15		678
1234	0.33	787	246	377	213	16		853
1237	0.14	755	281	355	74	15		725
Z1		0.047	0.055	0.231	0.630	0.315		0.287



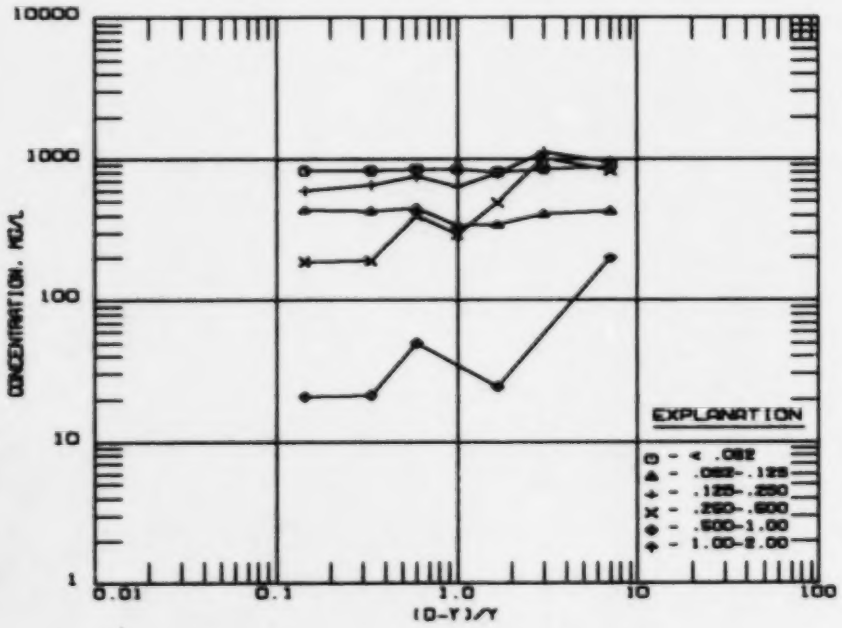
14241100 - North Fork Toutle River at Kid Valley, WA

February 14, 1986 File No.: 5.2

Depth: 3.2 ft
Water temperature: 3.5 degrees C
Stream discharge: 895 cubic feet per second
Water-surface slope: 0.00500

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1241	0.4	—	3310	27	40	69	94	100	
1243	0.8	—	3420	25	37	70	100		
1245	1.2	—	2440	33	47	79	99	100	
1247	1.6	—	2110	40	56	86	100		
1248	2.0	—	2510	34	52	82	98	100	
1250	2.4	—	2130	39	59	90	99	100	
1300	2.8	—	2060	40	61	90	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1241	7.00	8[illegible]	430	960	828	199		2420
1243	3.00	855	410	1130	1030			2560
1245	1.67	805	342	781	488	24		1630
1247	1.00	844	338	633	295			1270
1248	0.60	853	452	753	402	50		1660
1250	0.33	831	426	660	192	21		1300
1300	0.14	824	433	597	185	21		1240
Z1		0.015	-0.018	0.146	0.462	0.523		0.195



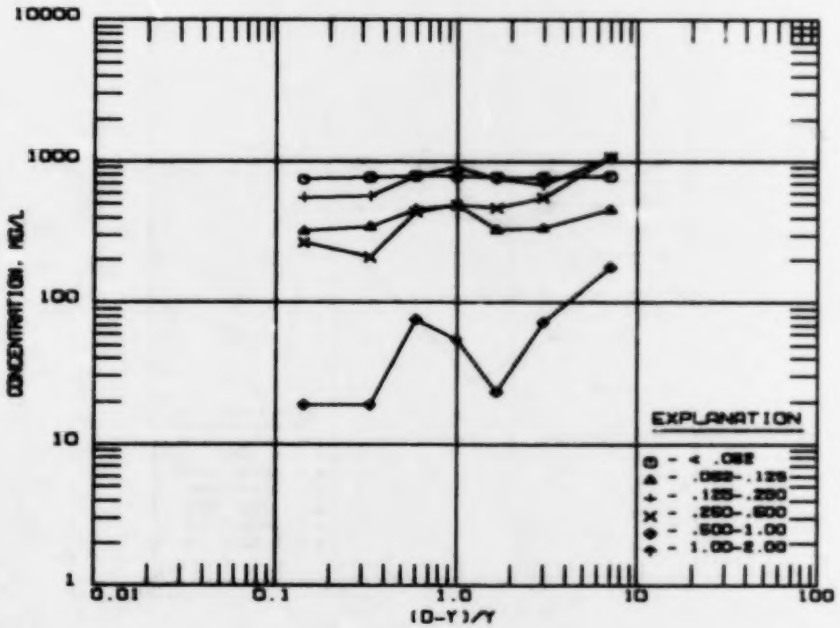
14241100 - North Fork Toutle River at Kid Valley, WA

February 14, 1986 File No.: 5.3

Depth: 3.2 ft
Water temperature: 3.6 degrees C
Stream discharge: 901 cubic feet per second
Water-surface slope: 0.00900

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1315	0.4	—	3360	22	35	65	95	100	
1317	0.8	—	2420	32	46	74	97	100	
1319	1.2	—	2350	33	47	79	99	100	
1321	1.6	—	2740	29	47	80	98	100	
1323	2.0	—	2350	31	49	80	97	100	
1325	2.4	—	1910	40	58	88	99	100	
1326	2.8	—	1910	39	56	85	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1315	7.00	783	463	1070	1070	178		2780
1317	3.00	774	339	678	557	73		1650
1319	1.67	776	329	752	470	24		1570
1321	1.00	795	493	904	493	55		1950
1323	0.60	790	459	790	434	76		1760
1325	0.33	764	344	573	210	19		1150
1326	0.14	745	325	554	267	19		1170
Z1		0.010	0.048	0.137	0.362	0.496		0.193



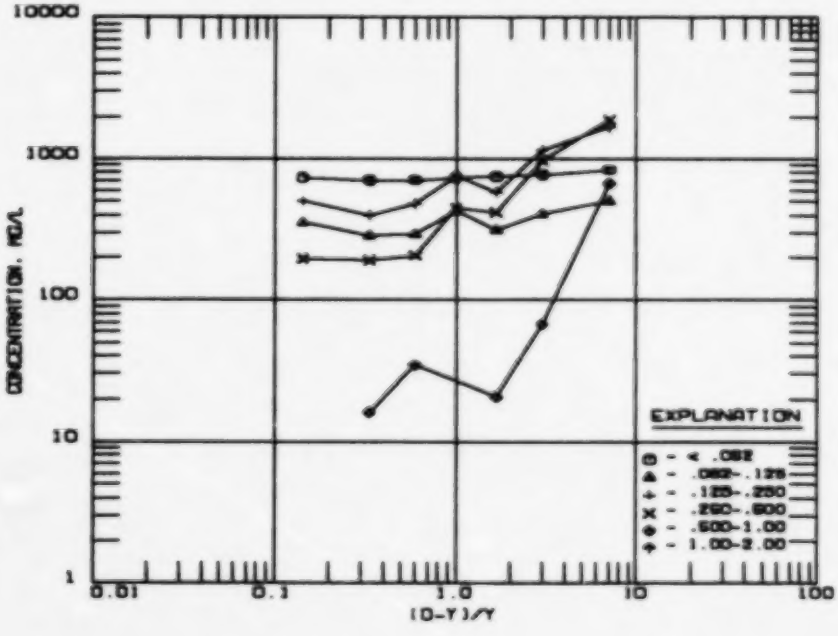
14241100 - North Fork Toutle River at Kid Valley, WA

February 14, 1986 File No.: 5.4

Depth: 3.2 ft
Stream discharge: 901 cubic feet per second
Water temperature: 3.6 degrees C
Water-surface slope: 0.00500

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1331	0.4	—	5580	15	24	54	88	100	
1332	0.8	—	3380	23	35	69	98	100	
1334	1.2	—	2080	36	51	79	99	100	
1336	1.6	—	2370	31	49	81	100		
1337	2.0	—	1730	41	58	86	98	100	
1339	2.4	—	1600	44	62	87	99	100	
1342	2.8	—	1780	41	61	89	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1331	7.00	837	502	1670	1900	670		4740
1332	3.00	777	406	1150	980	68		2600
1334	1.67	749	312	582	416	21		1330
1336	1.00	735	427	758	450			1640
1337	0.60	709	294	484	208	35		1020
1339	0.33	704	288	400	192	16		896
1342	0.14	730	356	498	196			1050
Z1		0.038	0.102	0.344	0.625	1.035		0.404



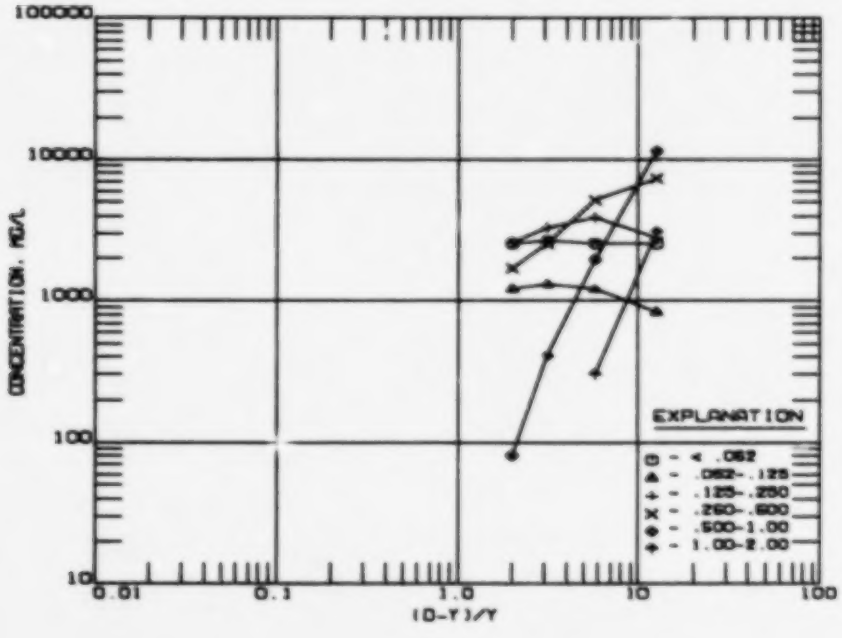
14241100 - North Fork Toutle River at Kid Valley, WA

February 16, 1986 File No.: 6.1

Depth: 5.4 ft
Water temperature: 4.2 degrees C
Stream discharge: 2,790 cubic feet per second
Water-surface slope: 0.00409

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm					
				0.062	0.125	0.250	0.500	1.00	2.00
1618	0.4	--	28100	9	12	22	48	89	100
1623	0.8	--	15100	17	25	51	85	98	100
1628	1.3	--	10200	26	39	71	96	100	
1633	1.8	--	8150	31	46	78	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1618	12.50	2530	843	2810	7310	11500	3090	25600
1623	5.75	2570	1210	3930	5130	1960	302	12500
1628	3.15	2650	1330	3260	2550	408		7550
1633	2.00	2530	1220	2610	1710	82		5620
Z1		-0.007	-0.214	0.042	0.815	2.663		0.835



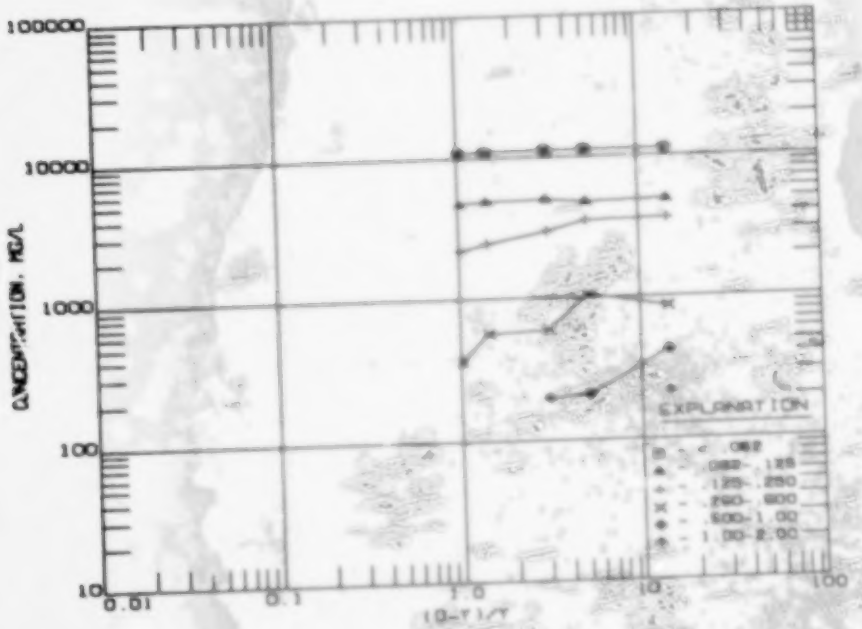
14241100 - North Fork Toutle River at Kid Valley, WA

February 24, 1986 File No.: 7-1

Depth: 6.1 ft
Water temperature: 8.7 degrees C
Stream discharge: 10,100 cubic feet per second
Water-surface slope: 0.00332

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1209	0.4	—	21300	53	76	93	97	99	100
1211	1.0	—	21000	54	77	94	99	100	
1214	1.5	—	20000	56	81	96	99	100	
1216	2.5	—	19000	58	84	97	100		
1219	3.0	—	18300	60	86	98	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1209	14.25	11300	4900	3620	852	426	213	10000
1211	5.10	11300	4830	3570	1050	210		9660
1214	3.07	11200	5000	3000	600	200		8800
1216	1.44	11000	4940	2470	570			7980
1219	1.03	11000	4760	2200	366			7320
Z1		0.012	0.004	0.199	0.317	0.521		0.120



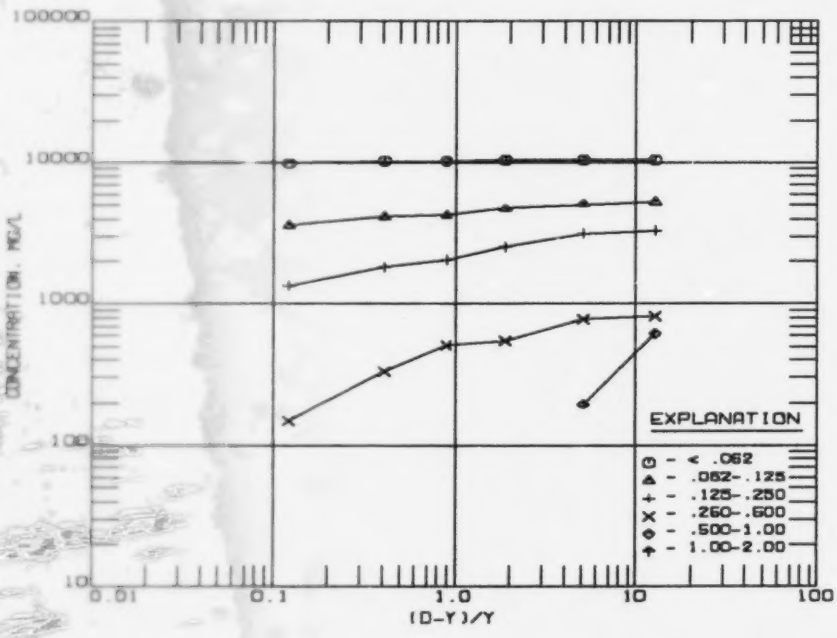
14241100 - North Fork Toutle River at Kid Valley, WA

February 24, 1986 File No.: 7.2

Depth: 5.5 ft
Water temperature: 8.8 degrees C
Stream discharge: 10,000 cubic feet per second
Water-surface slope: 0.00332

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1230	0.4	—	20500	51	77	93	97	100	
1233	0.9	—	19600	53	79	95	99	100	
1235	1.9	—	18300	57	83	97	100		
1238	2.9	—	17100	60	85	97	100		
1240	3.9	—	16600	62	87	98	100		
1243	4.9	—	15000	66	90	99	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1230	12.75	10500	5330	3280	820	615		10000
1233	5.11	10400	5100	3140	784	196		9210
1235	1.89	10400	4760	2560	549			7870
1238	0.90	10300	4280	2050	513			6840
1240	0.41	10300	4150	1830	332			6310
1243	0.12	9900	3600	1350	150			5100
Z1		0.010	0.085	0.199	0.357			0.148



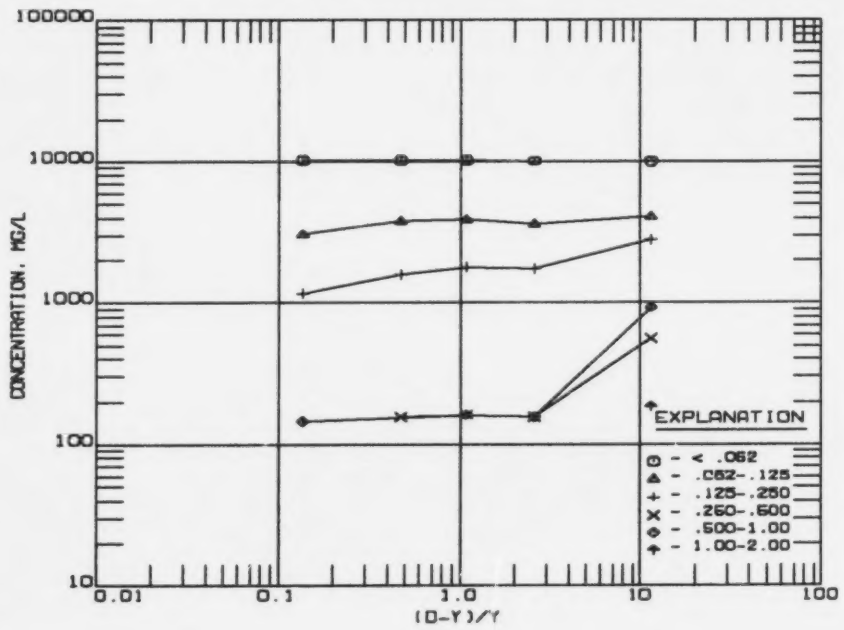
14241100 - North Fork Toutle River at Kid Valley, WA

February 24, 1986 File No.: 7.3

Depth: 5.0 ft
Water temperature: 9.1 degrees C
Stream discharge: 9,870 cubic feet per second
Water-surface slope: 0.00332

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1341	0.4	--	18600	54	76	91	94	99	100
1348	1.4	--	15800	64	87	98	99	100	
1353	2.4	--	16200	63	87	98	99	100	
1358	3.4	--	15700	65	89	99	100		
1403	4.4	--	14600	70	91	99	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1341	11.50	10000	4090	2790	558	930	186	8560
1348	2.57	10100	3630	1740	158	158		5690
1353	1.08	10200	3890	1780	162	162		5990
1358	0.47	10200	3770	1570	157			5500
1403	0.14	10200	3070	1170		146		4380
Z1		-0.004	0.053	0.179	0.397	0.375		0.135



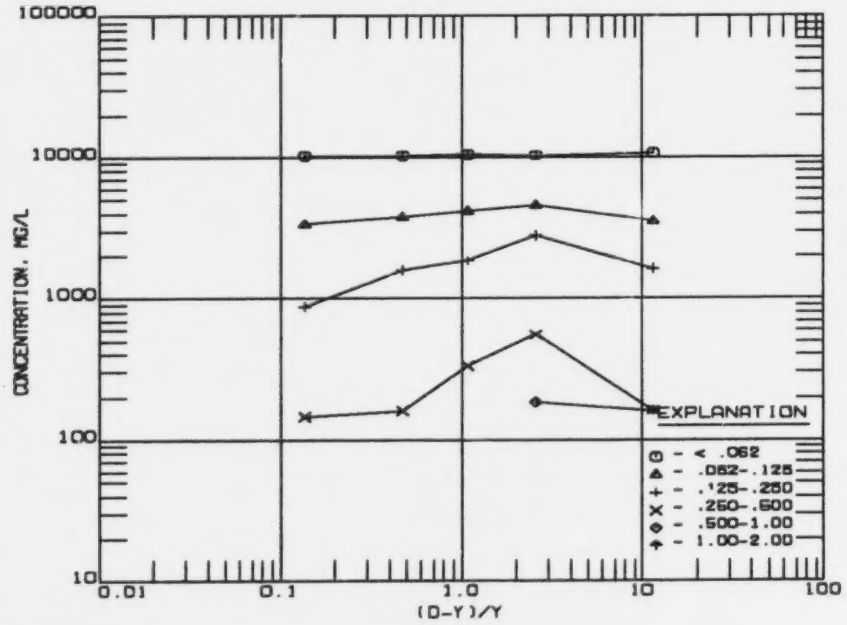
14241100 - North Fork Toutle River at Kid Valley, WA

February 24, 1986 File No.: 7.4

Depth: 5.0 ft
Water temperature: 9.1 degrees C
Stream discharge: 9,860 cubic feet per second
Water-surface slope: 0.00332

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1345	0.4	—	16200	66	88	98	99	100	
1350	1.4	—	18500	56	81	96	99	100	
1355	2.4	—	16800	62	87	98	100		
1401	3.4	—	15900	65	89	99	100		
1406	4.4	—	14700	70	93	99	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1345	11.30	10700	3560	1620	162	162		5510
1350	2.57	10400	4620	2780	555	185		8140
1355	1.08	10400	4200	1850	336			6380
1401	0.47	10300	3820	1590	159			5560
1406	0.14	10300	3380	882	147			4410
Z1		0.008	0.022	0.154	0.103			0.068



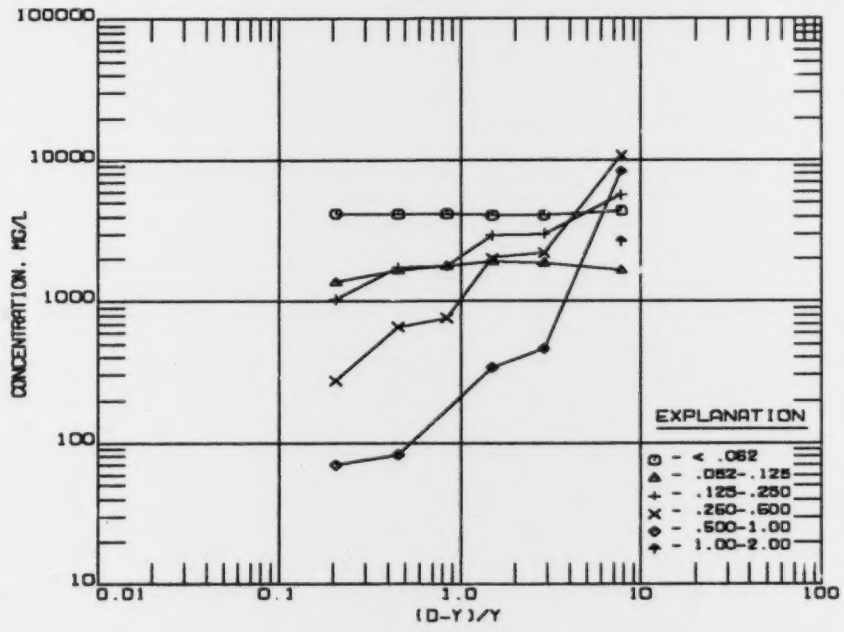
14241100 - North Fork Toutle River at Kid Valley, WA

February 27, 1986 File No.: 8.1

Depth: 3.5 ft
Water temperature: 11.7 degrees C
Stream discharge: 3,100 cubic feet per second
Water-surface slope: 0.00377

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1518	0.4	--	33500	13	18	35	67	92	100
1510	0.9	--	11600	35	51	77	96	100	
1501	1.4	--	11300	36	53	79	97	100	
1456	1.9	--	8500	49	70	91	100		
1451	2.4	--	8300	50	70	91	99	100	
1446	2.9	--	6950	60	80	95	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1518	7.75	4360	1680	5700	10700	8380	2680	29100
1510	2.89	4060	1860	3020	2200	464		7540
1501	1.50	4070	1920	2940	2030	339		7230
1456	0.84	4160	1780	1780	765			4340
1451	0.46	4150	1660	1740	664	83		4150
1446	0.21	4170	1390	1040	278	70		2780
Z1		0.007	0.052	0.442	0.954	1.249		0.595



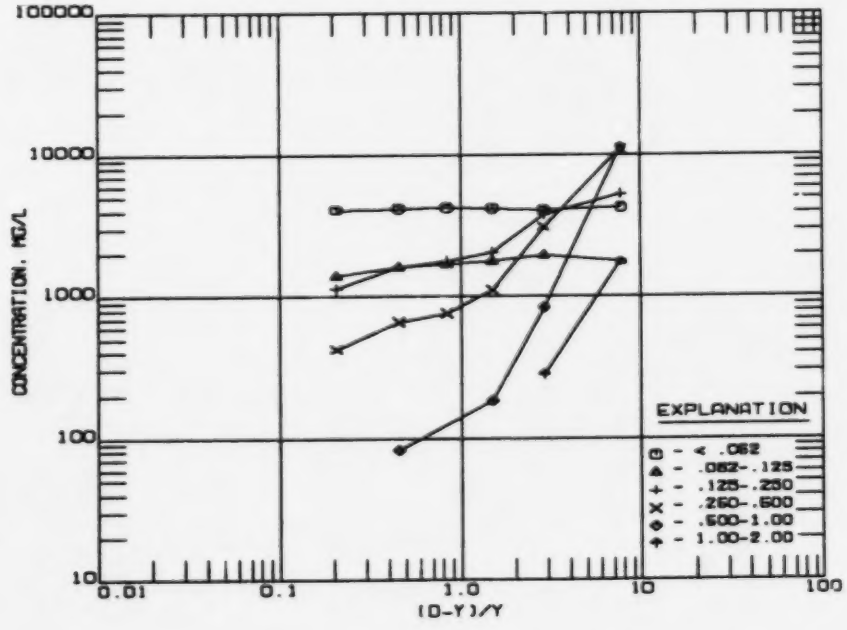
14241100 - North Fork Toutle River at Kid Valley, WA

February 27, 1986 File No.: 8.2

Depth: 3.5 ft
Water temperature: 11.7 degrees C
Stream discharge: 3,100 cubic feet per second
Water-surface slope: 0.00377

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1520	0.4	—	35300	12	17	32	63	95	100
1514	0.9	—	14100	29	43	70	92	98	100
1508	1.4	—	9300	45	64	86	98	100	
1459	1.9	—	8470	50	70	91	100		
1454	2.4	—	8200	51	71	91	99	100	
1449	2.9	—	7110	58	78	94	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1520	7.75	4240	1760	5300	10900	11300	1760	31100
1514	2.89	4090	1970	3810	3100	846	282	10000
1508	1.50	4180	1770	2050	1120	186		5120
1459	0.84	4240	1690	1780	762			4240
1454	0.46	4180	1640	1640	656	82		4020
1449	0.21	4120	1420	1140	427			2990
Z1		0.003	0.066	0.429	0.891	1.746		0.619



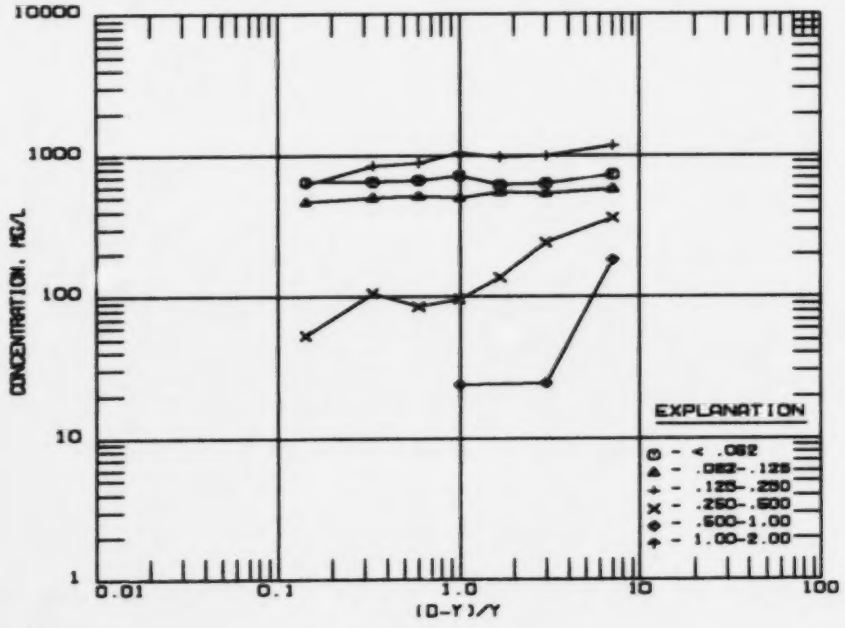
14241100 - North Fork Toutle River at Kid Valley, WA

May 6, 1986 File No.: 9.1

Depth: 3.2 ft
Station: 195
Water temperature: 7.5 degrees C
Stream discharge: 1,430 cubic feet per second
Water-surface slope: 0.00446

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1220	0.4	—	3040	24	43	82	94	100	
1222	0.8	—	2440	26	48	89	99	100	
1224	1.2	—	2290	27	51	94	100		
1226	1.6	—	2410	30	51	95	99	100	
1228	2.0	—	2160	31	55	96	100		
1230	2.4	—	2120	31	55	95	100		
1233	2.8	—	1800	36	62	97	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1220	7.00	730	578	1190	365	182		2310
1222	3.00	634	537	1000	244	24		1810
1224	1.67	618	550	985	137			1670
1226	1.00	723	506	1060	96	24		1690
1228	0.60	670	518	886	86			1490
1230	0.33	657	509	848	106			1460
1233	0.14	648	468	630	54			1150
Z1		0.014	0.047	0.140	0.463	0.990		0.156



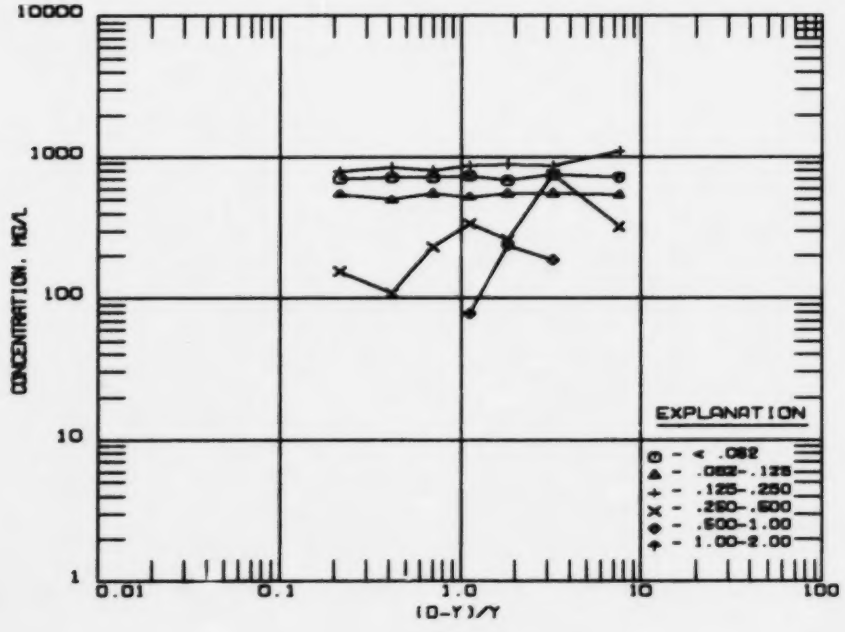
14241100 - North Fork Toutle River at Kid Valley, WA

May 6, 1986 File No.: 9.2

Depth: 3.4 ft
Station: 195
Water temperature: 7.5 degrees C
Stream discharge: 1,410 cubic feet per second
Water-surface slope: 0.00446

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1250	0.4	—	2680	27	47	88	100		
1252	0.8	—	3110	24	42	70	94	100	
1254	1.2	—	2630	26	47	81	91	100	
1257	1.6	—	2610	28	48	81	94	97	100
1259	2.0	—	2310	31	55	90	100		
1300	2.4	—	2170	33	56	95	100		
1303	2.8	—	2190	32	57	93	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1250	7.50	724	536	1100	322			1960
1252	3.25	746	560	871	746	187		2360
1254	1.83	684	552	894	263	237		1950
1257	1.13	731	522	861	339	78	78	1880
1259	0.70	716	554	808	231			1590
1300	0.42	716	499	846	108			1450
1303	0.21	701	548	788	153			1490
Z1		0.009	0.009	0.076	0.373	0.783		0.120



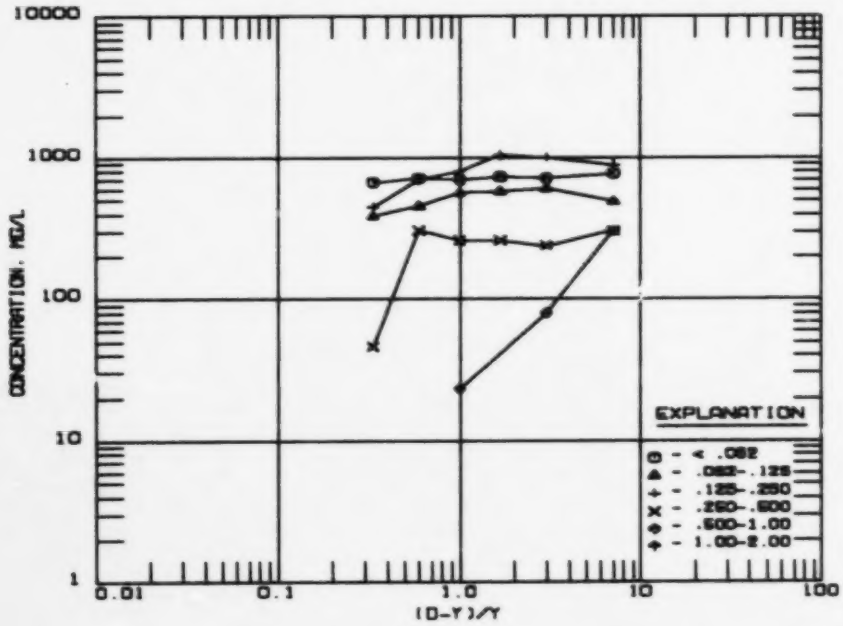
14241100 - North Fork Toutle River at Kid Valley, WA

May 6, 1986 File No.: 9.3

Depth: 3.2 ft
Station: 195
Water temperature: 7.5 degrees C
Stream discharge: 1,410 cubic feet per second
Water-surface slope: 0.00446

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1314	0.4	—	2760	28	46	78	89	100	
1315	0.8	—	2660	27	50	88	97	100	
1317	1.2	—	2620	28	50	90	100		
1319	1.6	—	2360	30	54	88	99	100	
1321	2.0	—	2180	33	54	86	100		
1324	2.4	—	1560	43	68	97	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1314	7.00	773	497	883	304	304		1990
1315	3.00	718	612	1010	239	80		1940
1317	1.67	734	576	1050	262			1890
1319	1.00	708	566	802	260	24		1650
1321	0.60	719	458	698	305			1460
1324	0.33	671	390	452	47			899
Z1		0.037	0.092	0.216	0.410	1.303		0.235



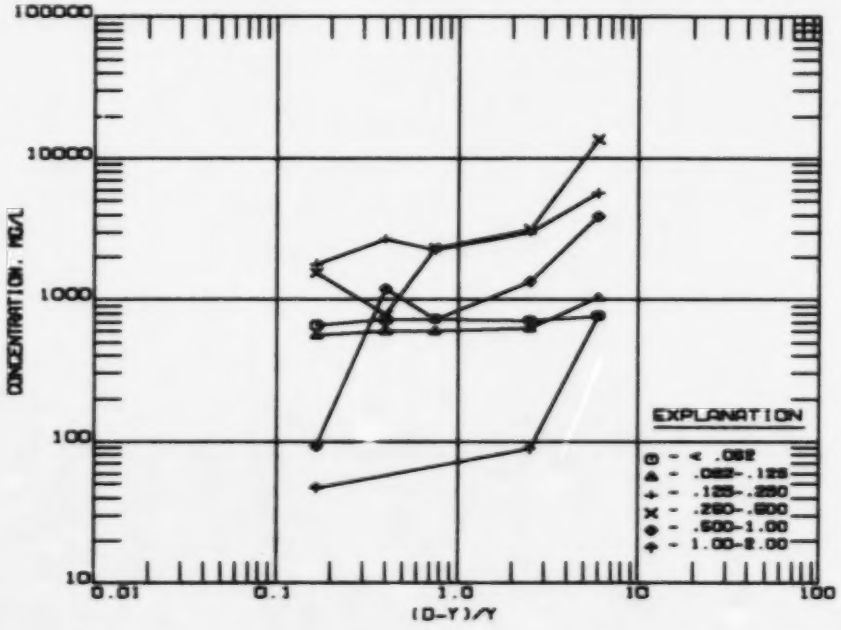
14241100 - North Fork Toutle River at Kid Valley, WA

May 6, 1986 File No.: 9.4

Depth: 2.8 ft
Station: 185
Water temperature: 7.5 degrees C
Stream discharge: 1,410 cubic feet per second
Water-surface slope: 0.00446

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1335	0.4	—	25700	3	7	29	82	97	100
1338	0.8	—	8920	8	15	49	84	99	100
1340	1.6	—	6680	11	20	54	89	100	
1343	2.0	—	5990	12	22	67	80	100	
1345	2.4	—	4700	14	26	64	97	99	100

Time	(D-Y)/Y	Concentration, in mg/L, of size class, in mm: Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 2.00
1335	6.00	771	1030	5650	13600	3860	771	24900
1338	2.50	714	624	3030	3120	1340	89	8210
1340	0.75	735	601	2270	2340	735		5950
1343	0.40	719	599	2700	779	1200		5270
1345	0.17	658	564	1790	1550	94	47	4040
Z1		0.033	0.140	0.274	0.636	0.832	0.652	0.458



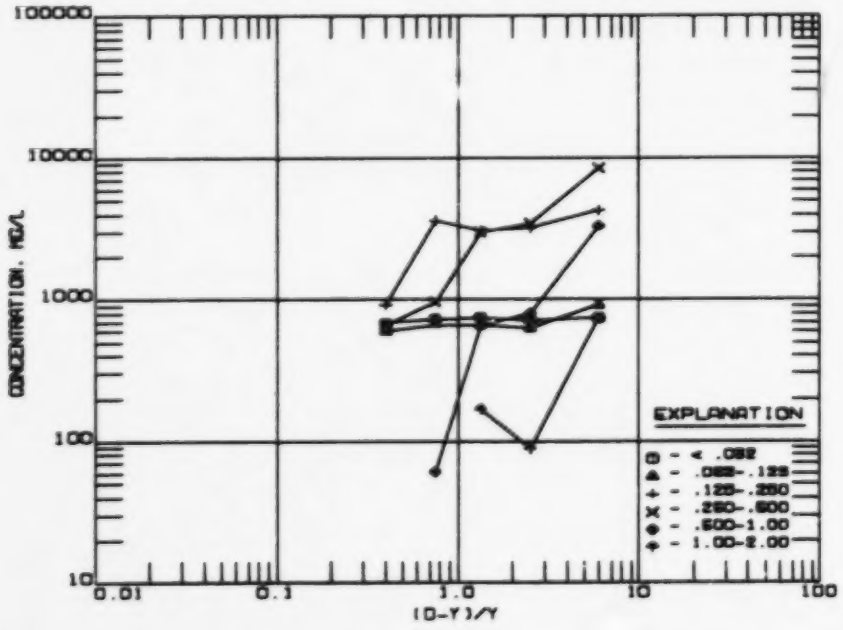
14241100 - North Fork Toutle River at Kid Valley, WA

May 6, 1986 File No.: 9.5

Depth: 2.8 ft
Station: 185
Water temperature: 7.5 degrees C
Stream discharge: 1,410 cubic feet per second
Water-surface slope: 0.00446

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1352	0.4	—	18500	4	9	32	78	96	100
1354	0.8	—	8910	8	15	51	90	99	100
1355	1.2	—	8340	9	17	54	90	98	100
1358	1.6	—	6080	12	23	83	99	100	
1359	2.0	—	2860	24	45	77	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1352	6.00	740	925	4260	8510	3330	740	17800
1354	2.50	713	624	3210	3470	802	89	8200
1355	1.33	751	667	3090	3000	667	167	7590
1358	0.75	730	669	3650	973	61		5350
1359	0.40	686	601	915	658			2170
Z1		0.019	0.128	0.436	0.960	1.741	1.081	0.698



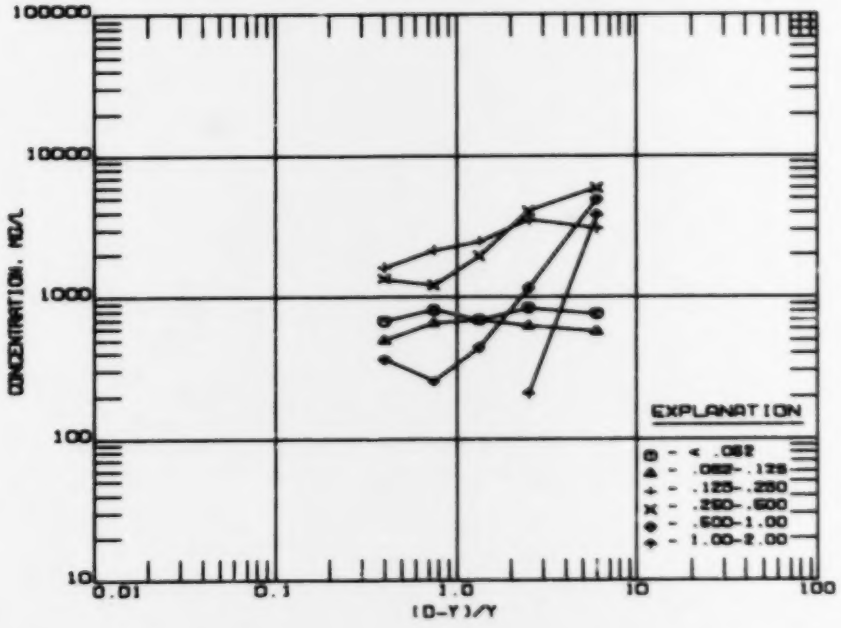
14241100 - North Fork Toutle River at Kid Valley, WA

May 6, 1986 File No.: 9.6

Depth: 2.8 ft
Station: 185
Water temperature: 7.5 degrees C
Stream Discharge: 1,410 cubic feet per second
Water-surface slope: 0.00446

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1402	0.4	—	19100	4	7	23	54	80	100
1404	0.8	—	10500	8	14	48	87	98	100
1406	1.2	—	6270	11	22	62	93	100	
1408	1.6	—	5090	16	29	71	95	100	
1409	2.0	—	4530	15	26	62	92	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1402	6.00	764	573	3060	5920	4970	3820	18300
1404	2.50	840	630	3570	4100	1160	210	9660
1406	1.33	690	690	2510	1940	439		5580
1408	0.75	814	662	2140	1220	254		4280
1409	0.40	680	498	1630	1360	362		3850
Z1		0.038	0.028	0.257	0.627	1.045		0.602



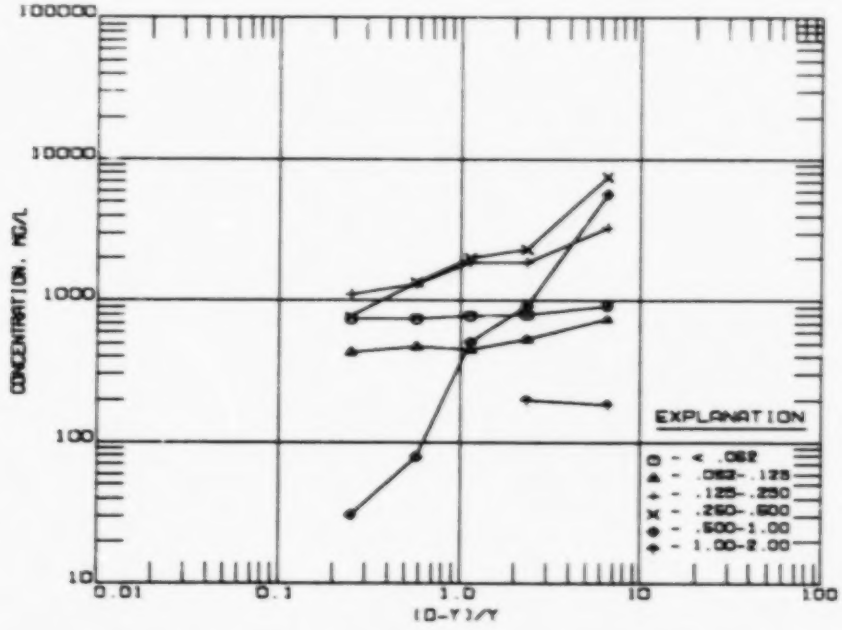
14241100 - North Fork Toutle River at Kid Valley, WA

May 21, 1986 File No.: 10.1

Depth: 3.0 ft
Station: 170
Water temperature: 10.0 degrees C
Stream discharge: 1,660 cubic feet per second
Water-surface slope: 0.00436

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1255	0.4	--	18400	5	9	27	68	99	100
1259	0.9	--	6620	12	20	48	83	97	100
1301	1.4	--	5620	14	22	55	91	100	
1303	1.9	--	3940	19	31	64	98	100	
1306	2.4	--	3090	24	38	74	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1255	6.50	920	736	3310	7540	5700	184	17500
1259	2.33	794	530	1850	2320	927	199	5830
1301	1.14	787	450	1850	2020	506		4830
1303	0.58	749	473	1300	1340	79		3190
1306	0.25	742	433	1110	772	31		2350
Z1		0.064	0.153	0.324	0.656	1.628		0.393



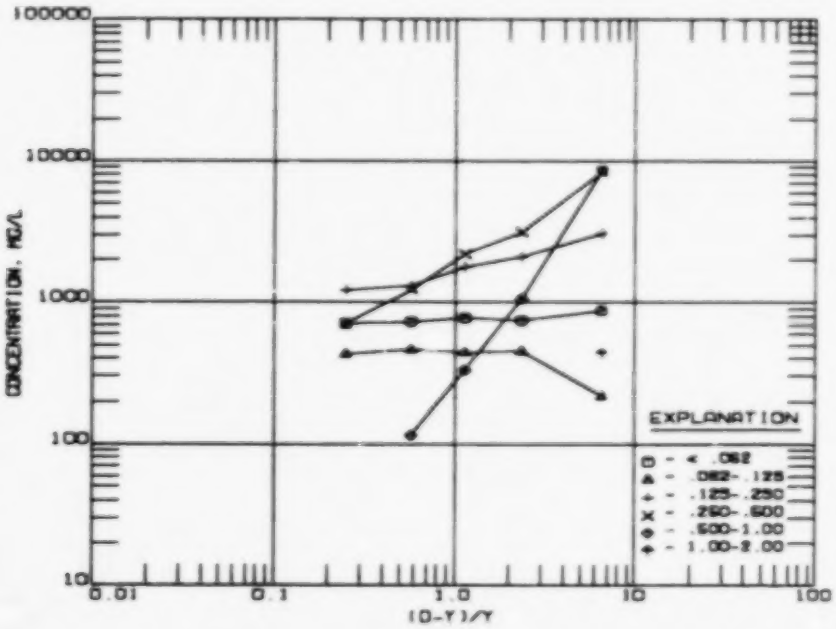
14241100 - North Fork Toutle River at Kid Valley, WA

May 21, 1986 File No.: 10.2

Depth: 3.0 ft
Station: 170
Water temperature: 10.0 degrees C
Stream discharge: 1,660 cubic feet per second
Water-surface slope: 0.00436

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm					
				0.062	0.125	0.250	0.500	1.00	2.00
1313	0.4	—	21900	4	5	19	58	98	100
1315	0.9	—	7510	10	16	44	86	100	
1317	1.4	—	5520	14	22	54	94	100	
1319	1.9	—	3860	19	31	65	97	100	
1321	2.4	—	3080	23	37	77	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1313	6.50	876	219	3070	8540	8760	438	21000
1315	2.33	751	451	2100	3150	1050		6760
1317	1.14	773	442	1770	2210	331		4750
1319	0.58	733	463	1310	1240	116		3130
1321	0.25	708	431	1230	708			2370
Z1		0.058	-0.186	0.291	0.752	1.787		0.658



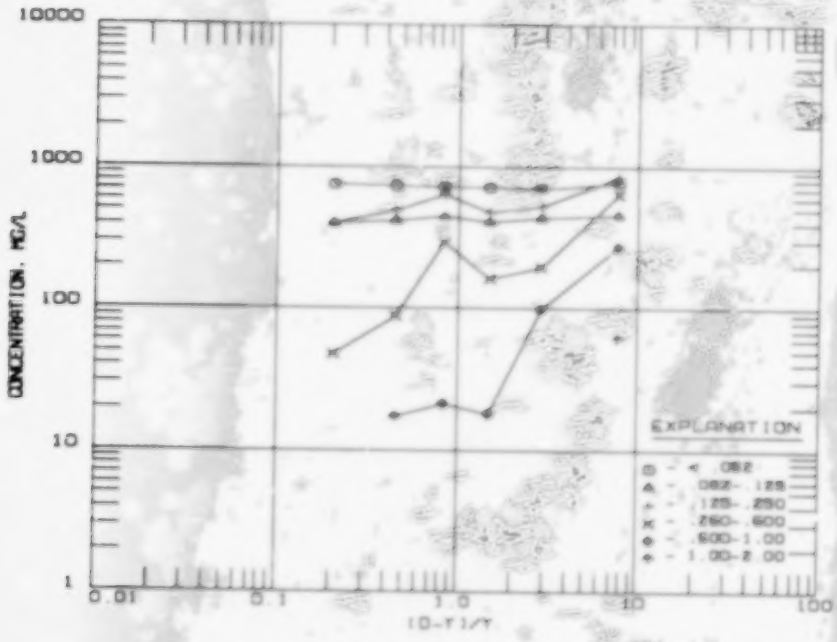
14241100 - North Fork Tautic River at Kid Valley, MA

May 21, 1986 File No.: 10.5

Depth: 3.5 ft
Station: 190
Water temperature: 10.0 degrees C
Stream discharge: 1,660 cubic feet per second
Water-surface slope: 0.00436

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1331	0.4	--	3050	25	40	68	89	98	100
1335	0.9	--	1970	36	58	85	99	100	
1337	1.4	--	1790	40	63	90	99	100	
1339	1.9	--	2110	34	55	85	99	100	
1341	2.4	--	1740	42	66	94	99	100	
1344	2.9	--	1600	47	72	97	100		

Time	(D-Y)/Y	Concentration, in mg/L, of size class, in mm Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1331	7.75	762	458	854	640	274	61	2290
1335	2.89	709	433	532	197	98		1260
1337	1.50	716	412	483	161	18		1070
1339	0.84	717	443	633	295	21		1390
1341	0.46	731	418	487	87	17		1010
1344	0.21	752	400	400	48			848
Z1		0.001	0.030	0.165	0.624	1.090		0.231



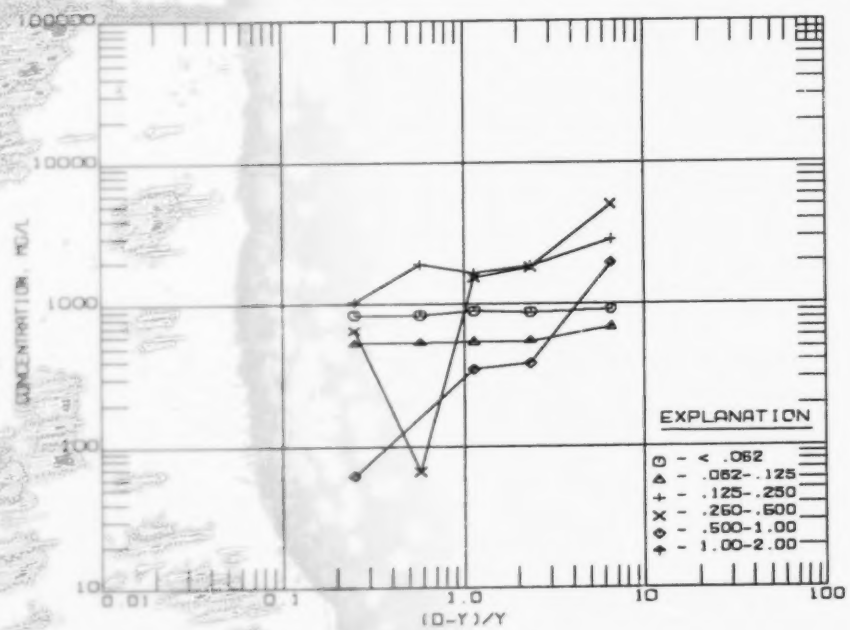
14241100 - North Fork Toutle River at Kid Valley, WA

May 21, 1986 File No.: 10.4

Depth: 3.0 ft
Station: 170
Water temperature: 11.0 degrees C
Stream discharge: 1,660 cubic feet per second
Water-surface slope: 0.00436

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1502	0.4	--	11500	8	14	39	83	100	
1505	0.9	--	5540	16	26	60	93	100	
1507	1.4	--	5000	18	29	62	93	100	
1509	1.9	--	3380	25	41	98	100		
1510	2.4	--	3110	27	44	77	98	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1502	6.50	920	690	2880	5060	1960		10600
1505	2.33	886	554	1880	1830	388		4650
1507	1.14	900	550	1650	1550	350		4100
1509	0.58	845	541	1930	68			2540
1510	0.25	840	529	1030	653	62		2270
Z1		0.029	0.073	0.263	0.914	1.008		0.471



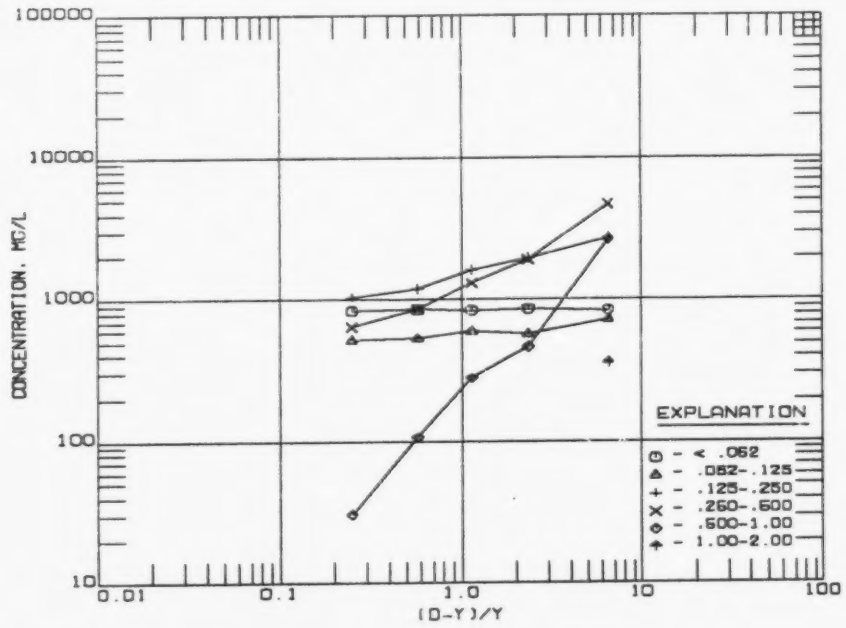
14241100 - North Fork Toutle River at Kid Valley, WA

May 21, 1986 File No.: 10.5

Depth: 3.0 ft
Station: 170
Water temperature: 11.0 degrees C
Stream discharge: 1,660 cubic feet per second
Water-surface slope: 0.00436

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1522	0.4	--	12000	7	13	36	75	97	100
1524	0.9	--	5760	15	25	59	92	100	
1526	1.4	--	4660	18	31	66	94	100	
1529	1.9	--	3540	24	39	73	97	100	
1531	2.4	--	3080	27	44	78	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1522	6.50	840	720	2760	4680	2640	360	11200
1524	2.33	864	576	1960	1900	461		4900
1526	1.14	839	606	1630	1300	280		3820
1529	0.58	850	531	1200	850	106		2690
1531	0.25	832	524	1050	647	31		2250
Z1		0.004	0.093	0.306	0.607	1.318		0.487



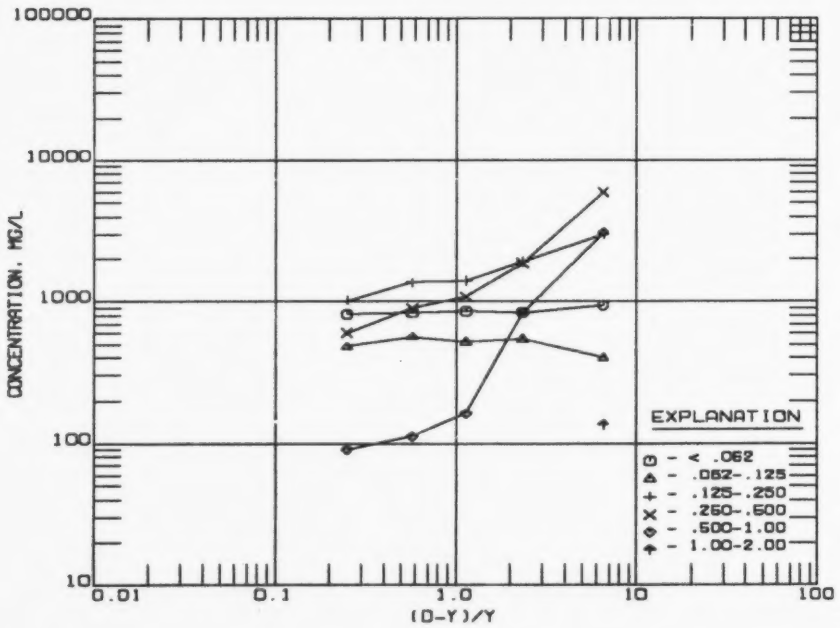
14241100 - North Fork Toutle River at Kid Valley, WA

May 21, 1986 File No.: 10.6

Depth: 3.0 ft
Station: 170
Water temperature: 11.0 degrees C
Stream discharge: 1,660 cubic feet per second
Water-surface slope: 0.00436

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1537	0.4	--	13500	7	10	32	76	99	100
1539	0.9	--	6040	14	23	55	86	100	
1542	1.4	--	4060	21	34	69	96	100	
1544	1.9	--	3780	22	37	73	97	100	
1546	2.4	--	3010	27	43	77	97	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1537	6.50	945	405	2970	5940	3100	135	12600
1539	2.33	846	544	1930	1870	846		5190
1542	1.14	853	528	1420	1100	162		3210
1544	0.58	832	567	1360	907	113		2950
1546	0.25	813	482	1020	602	90		2200
Z1		0.042	-0.053	0.317	0.681	1.154		0.521



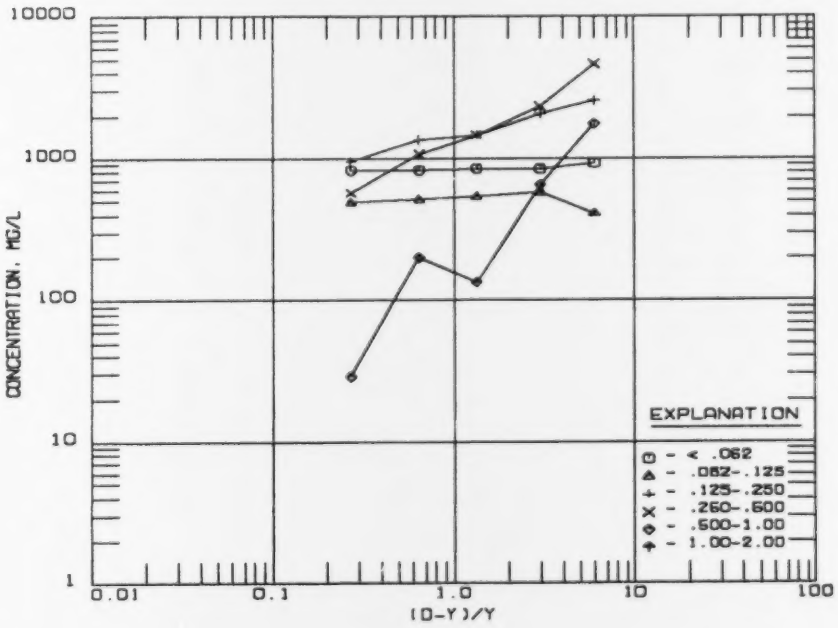
14241100 - North Fork Toutle River at Kid Valley, WA

May 21, 1986 File No.: 10.7

Depth: 2.8 ft
Station: 170
Water temperature: 11.0 degrees C
Stream discharge: 1,660 cubic feet per second
Water-surface slope: 0.00436

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1552	0.4	--	10300	9	13	38	83	100	
1554	0.7	--	6500	13	22	54	90	100	
1556	1.2	--	4470	19	31	64	97	100	
1557	1.7	--	3980	21	34	68	95	100	
1559	2.2	--	2870	29	46	79	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1552	6.00	927	412	2580	4640	1750		9370
1554	3.00	845	585	2080	2340	650		5660
1556	1.33	849	536	1480	1480	134		3620
1557	0.65	836	517	1350	1070	199		3140
1559	0.27	832	488	947	574	29		2040
Z1		0.029	-0.025	0.316	0.641	1.225		0.471



14241490 -- South Fork Toutle River at Camp 12 near Toutle, WA

LOCATION.--Lat 46°19'05", long 122°40'01", in NE1/4 SW1/4 sec.35, T.10 N., R.1 E., Cowlitz County, Hydrologic Unit 17080005, on right bank 0.9 mi downstream from Johnson Creek, 1.2 mi southeast of Toutle, and at mile 3.4.

DRAINAGE AREA.--117 mi^2.

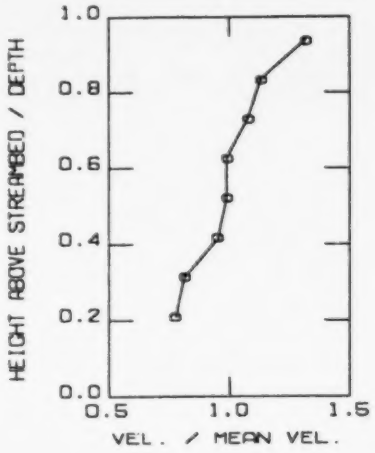
REACH DESCRIPTION.--The South Fork Toutle River channel was covered on May 18, 1980 with massive sediment deposits from a muddy debris flow. Annual sediment yields are greater than sediment yields prior to the eruption. Vertical-profile data were collected from the cableway at the gaging station cross section in 1982. Immediately after the eruption, the channel in the cross section had a sand bed; by early 1982, the channel was armored with cobble.

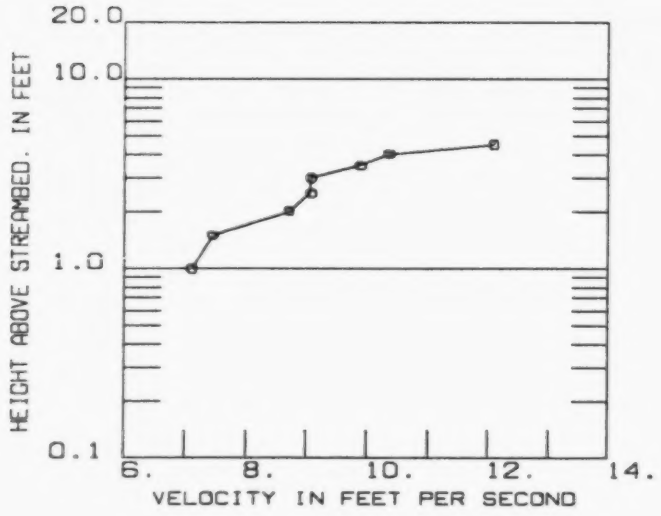
14241490 - South Fork Toutle River at Camp 12 near Toutle, WA

February 20, 1982 File No.: 1.1

Depth: 4.8 ft
Mean velocity: 9.17 ft/s
Water-surface slope: 0.00200
Stream discharge: 8,070 cubic feet per second

Time	Height above Bed (ft)	Velocity (ft/s)
1645	1.0	7.11
1651	1.5	7.46
1652	2.0	8.71
1652	2.5	9.07
1652	3.0	9.07
1653	3.5	9.89
1653	4.0	10.36
1655	4.5	12.09



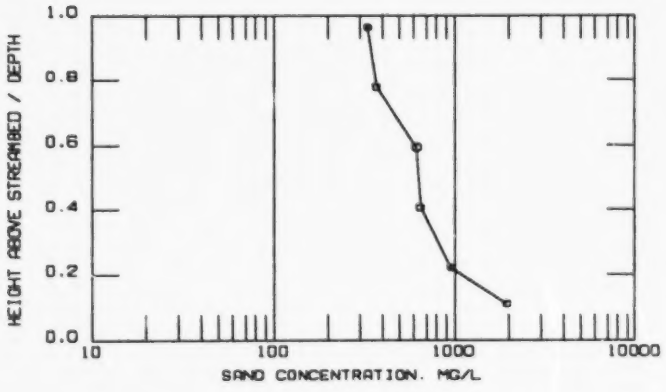


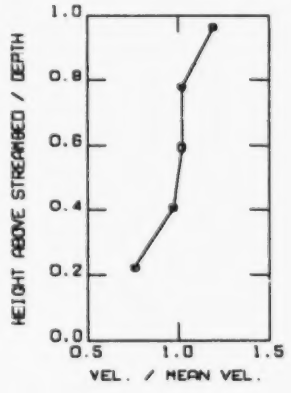
14241490 - South Fork Toutle River at Camp 12 near Toutle, WA

February 25, 1982 File No.: 2.1

Depth: 2.7 ft
Station: 56
Water temperature: 7.5 degrees C
Stream discharge: 1,040 cubic feet per second
Mean velocity: 5.81 ft/s
Water-surface slope: 0.00200

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Pct finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Coarser than 0.062
1240	0.3	--	2110	8	8.00	169	1940
1240	0.6	4.43	1100	13	3.50	143	957
1240	1.1	5.67	792	18	1.45	143	649
1240	1.6	5.94	755	18	0.69	136	619
1240	2.1	5.95	502	26	0.29	131	371
1240	2.6	6.94	459	28	0.04	129	330
Z1						0.045	0.316



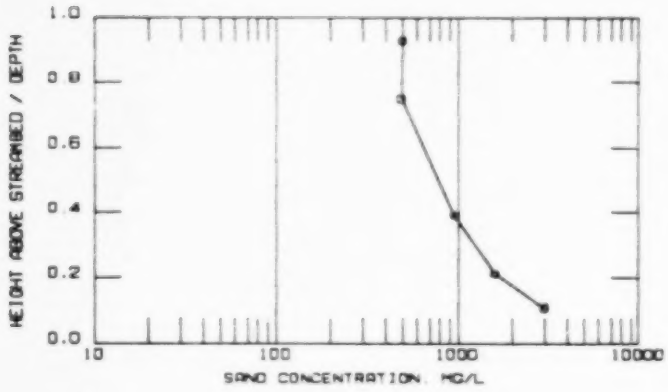


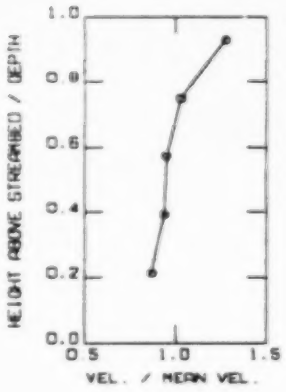
14241490 - South Fork Toutle River at Camp 12 near Toutle, WA

February 25, 1982 File No.: 2.2

Depth: 2.8 ft
Station: 68
Water temperature: 7.5 degrees C
Stream discharge: 1,040 cubic feet per second
Mean velocity: 7.20 ft/s
Water-surface slope: 0.00200

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Pct finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Concentration, mg/L Coarser than 0.062
1250	0.3	--	3160	5	8.33	158	3000
1250	0.6	6.28	1740	8	3.67	139	1600
1250	1.1	6.77	1090	12	1.55	131	959
1250	1.6	6.85	—		0.75		
1250	2.1	7.44	617	21	0.33	130	487
1250	2.6	9.19	630	21	0.08	132	498
Z1						0.032	0.389



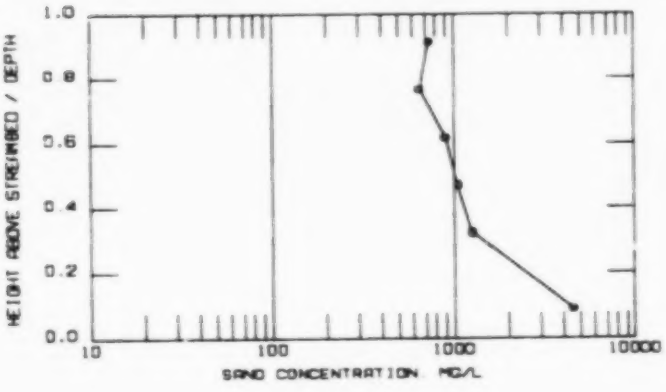


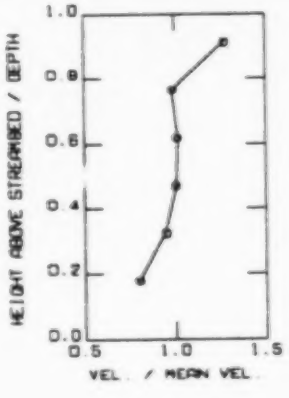
14241490 - South Fork Toutle River at Camp 12 near Toutle, WA

February 25, 1982 File No.: 2.3

Depth: 3.4 ft
Station: 76
Water temperature: 7.5 degrees C
Stream discharge: 1,040 cubic feet per second
Mean velocity: 7.49 ft/s
Water-surface slope: 0.00200

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Pct finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Concentration, mg/L Coarser than 0.062
1300	0.3	—	4680	3	10.33	140	4540
1300	0.6	6.00	—		4.67		
1300	1.1	7.11	1400	10	2.09	140	1260
1300	1.6	7.55	1180	11	1.13	130	1050
1300	2.1	7.60	1030	13	0.62	134	896
1300	2.6	7.39	776	16	0.31	124	652
1300	3.1	9.57	858	15	0.10	129	729
Z1						0.024	0.395



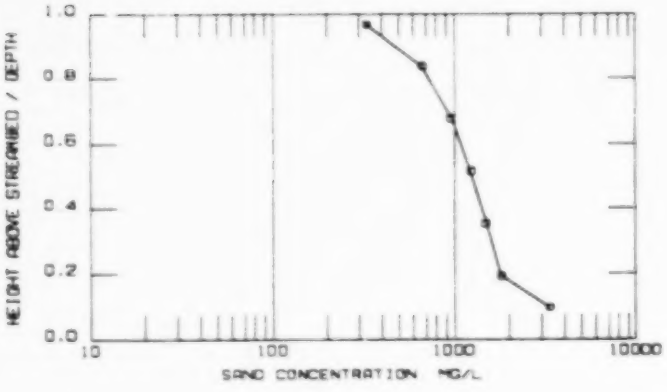


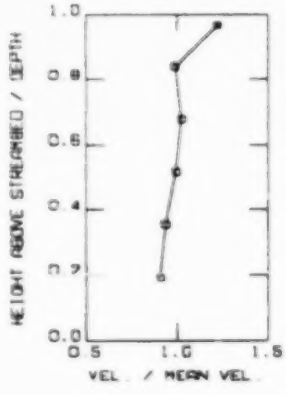
14241490 - South Fork Toutle River at Camp 12 near Toutle, WA

February 25, 1982 File No.: 2.4

Depth: 3.1 ft
Station: 86
Water temperature: 7.5 degrees C
Stream discharge: 1,040 cubic feet per second
Mean velocity: 7.28 ft/s
Water-surface slope: 0.00200

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Pct finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Concentration, mg/L Coarser than 0.062
1310	0.3	--	3460	4	9.33	138	3320
1310	0.6	6.62	1930	7	4.17	135	1790
1310	1.1	6.84	1620	8	1.82	130	1490
1310	1.6	7.26	1370	10	0.94	137	1230
1310	2.1	7.48	1100	12	0.48	132	968
1310	2.6	7.22	796	16	0.19	127	669
1310	3.0	8.94	465	29	0.03	135	330
Z1						0.006	0.384



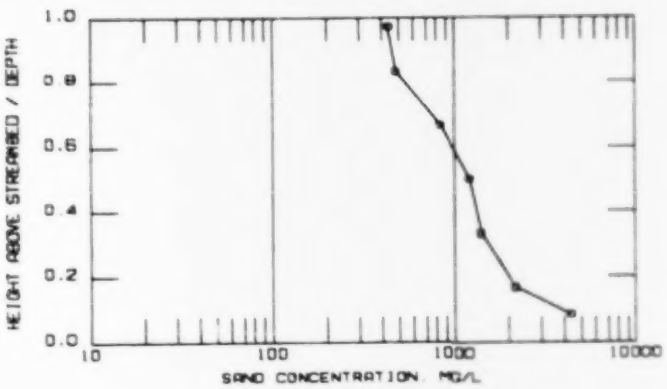


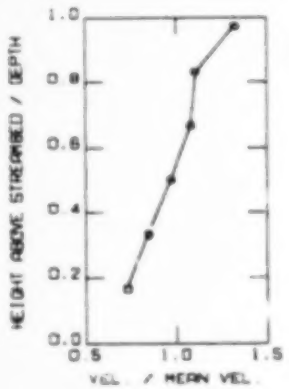
14241490 - South Fork Toutle River at Camp 12 near Toutle, WA

February 25, 1982 File No.: 2.5

Depth: 3.6 ft
Station: 96
Water temperature: 7.5 degrees C
Stream discharge: 1,040 cubic feet per second
Mean velocity: 5.51 ft/s
Water-surface slope: 0.00200

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Pct finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Concentration, mg/L Coarser than 0.062
1320	0.3	--	4490	3	11.00	135	4360
1320	0.6	4.02	2310	6	5.00	139	2170
1320	1.2	4.66	1550	9	2.00	140	1410
1320	1.8	5.35	1360	10	1.00	136	1220
1320	2.4	5.95	970	14	0.50	136	834
1320	3.0	6.10	612	22	0.20	135	477
1320	3.5	7.30	573	24	0.03	138	435
Z1						0.000	0.389





14241490 - South Fork Toutle River at Camp 12 near Toutle, WA

June 16, 1982 File No.: 3.1

Depth: 3.1 ft
Station: 310
Water temperature: 14.0 degrees C
Stream discharge: 270 cubic feet per second
Mean velocity: 1.50 ft/s
Water-surface slope: 0.00180

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Pct finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Concentration, mg/L Coarser than 0.062
1100	0.4	1.18	18	57	6.75	10	8
1100	0.7	1.26	12	57	3.43	7	5
1100	1.0	1.38	18	76	2.10	14	4
1100	1.3	1.62	18	94	1.38	17	1
1100	1.6	1.54	14	81	0.94	11	3
1100	1.9	1.65	16	67	0.63	11	5
1100	2.2	1.51	13	95	0.41	12	0
1100	2.5	1.73	10	72	0.24	7	3
1100	2.8	1.47	16	62	0.11	10	6
Z1						0.022	0.152

June 16, 1982 File No.: 3.2

Depth: 3.4 ft
Station: 319
Water temperature: 14.0 degrees C
Stream discharge: 270 cubic feet per second
Mean velocity: 2.26 ft/s
Water-surface slope: 0.00180

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Pct finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Concentration, mg/L Coarser than 0.062
1115	0.4	1.35	28	58	7.50	16	12
1115	0.7	1.73	19	43	3.86	8	11
1115	1.0	2.10	25	66	2.40	16	8
1115	1.3	2.20	23	68	1.62	15	8
1115	1.6	2.44	16	98	1.13	16	0
1115	1.9	2.39	18	71	0.79	13	5
1115	2.2	2.61	8	36	0.55	3	5
1115	2.5	2.50	9	42	0.36	4	5
1115	2.8	2.50	26	55	0.21	14	12
1115	3.1	2.44	35	56	0.10	20	15
Z1						0.064	-0.044

14241490 - South Fork Toutle River at Camp 12 near Toutle, WA

June 16, 1982 File No.: 3.3

Depth: 3.0 ft
Station: 326 ft
Water temperature: 14.0 degrees C
Stream discharge: 270 cubic feet per second
Mean velocity: 2.77 ft/s
Water-surface slope: 0.00180

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Pct finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Concentration, mg/L Coarser than 0.062
1130	0.3	1.62	--		9.00		
1130	0.6	2.25	21	61	4.00	13	8
1130	0.9	2.50	19	64	2.33	12	7
1130	1.2	2.86	23	71	1.50	16	7
1130	1.5	2.99	20	73	1.00	15	5
1130	1.8	2.99	23	78	0.67	18	5
1130	2.1	3.13	10	67	0.43	7	3
1130	2.4	3.06	16	82	0.25	13	3
1130	2.7	3.13	22	77	0.11	17	5
Z1						-0.010	0.225

June 16, 1982 File No.. 3.4

Depth: 2.4 ft
Stream discharge: 270 cubic feet per second
Water temperature: 14.0 degrees C
Station: 333
Mean velocity: 3.15 ft/s
Water-surface slope: 0.00180

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Pct finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Concentration, mg/L Coarser than 0.062
1145	0.4	1.54	9	29	5.00	3	6
1145	0.6	2.55	17	63	3.00	11	6
1145	0.8	2.50	21	63	2.00	13	8
1145	1.0	3.06	16	61	1.40	10	6
1145	1.2	3.28	23	68	1.00	16	7
1145	1.4	3.57	15	85	0.71	13	2
1145	1.6	3.72	23	58	0.50	13	10
1145	1.8	3.65	24	50	0.33	12	12
1145	2.0	3.57	7	58	0.20	4	3
1145	2.2	3.43	20	61	0.09	12	8
Z1						-0.111	0.013

14241490 - South Fork Tuttle River at Camp 12 near Tuttle, WA

June 16, 1982 File No.: 3.5

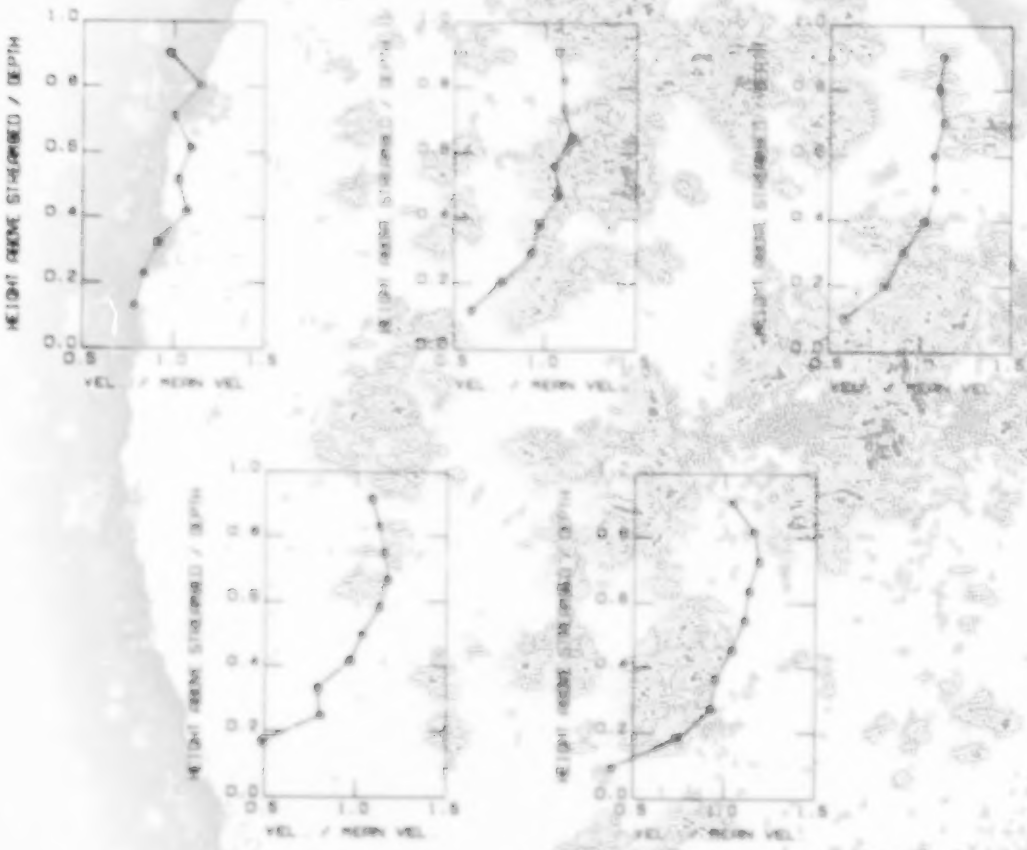
Depth: 2.2 ft
Station: 341
Water temperature: 14.0 degrees C
Stream discharge: 270 cubic feet per second
Mean velocity: 2.97 ft/s
Water-surface slope: 0.00180

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Pct finer than 0.062	(D-Perf	Concentration, mg/L Finer than 0.062	Coarser than 0.062
1200	0.2	0.97	11	62	10.00	11	6
1200	0.4	1.92	12	57	4.50	7	5
1200	0.6	2.39	9	88	2.67	8	1
1200	0.8	2.44	[illegible]	[illegible]	1.25	[illegible]	[illegible]
1200	1.0	2.68	12	49	0.20	6	6
1200	1.2	2.86	22	51	0.83	11	11
1200	1.4	2.92	8	60	0.57	5	3
1200	1.6	3.06	17	76	0.38	13	4
1200	1.8	2.99	11	89	0.22	10	1
1200	2.0	2.68	16	63	0.10	10	6

Z1 -0.045 0.070

June 16, 1982 File Nos. 3.1 - 3.5

Velocity Profiles



14242580 -- Toutle River at Tower Road near Silver Lake, WA

LOCATION.--Lat 46°20'02", long 122°50'20", in NW1/4 SW1/4 sec.20, T.10 N., R.1 W., Cowlitz County, Hydrologic Unit 17080005, on right bank 10 mi downstream from confluence of North and South Forks, 2.9 mi northwest of Silver Lake, and at mile 6.5.

DRAINAGE AREA.--496 mi^2.

REACH DESCRIPTION.--The muddy debris flows that inundated the North and South Forks of the Toutle River channel on May 18, 1980, passed through the main Toutle River. The highway bridge at Tower Road was destroyed by the North Fork Toutle River lahar on May 18, 1980, and it was replaced in 1981. Vertical-profile data were collected at the upstream side of the bridge. The upstream side of the bridge opening is shown in Figure 3. The bridge is 1,300 feet upstream from the cableway measuring section for the Toutle River at Tower Road gaging station. During storm runoff, the approach section of the channel was nearly perpendicular to the bridge; but during low flow, the approach deviated from perpendicular by as much as 20 degrees. The cross section is deepest between the right bank and the rightmost pier. Flow converges from the approach as it passes through this section. The section to the left of the rightmost pier is shallower and less affected by convergent flow. To avoid the convergent flow, most vertical-profile measurements were made at a single vertical located to the left of the rightmost pier. The right bank of the approach consists of unprotected lahar deposits and older consolidated soils. The left bank is riprapped from a point 300 feet upstream of the bridge to the bridge wingwalls.

During low flow, gravel bars are exposed on the left side of the approach channel from the upstream point of riprap through the left side of the bridge cross section. During storm flow, the channel through the bridge opening has a sand bed, but continued low flow exposes a sand-and-gravel streambed.

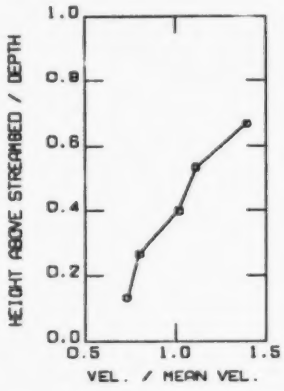
Figure 5.--Bridge opening at Toutle River at Tower Road.

14242580 - Toutle River at Tower Road near Silver Lake, WA

January 17, 1982 File No.: 1.1

Depth: 7.5 ft
Station: 168
Mean velocity: 9.28 ft/s
Stream discharge: 10,100 cubic feet per second

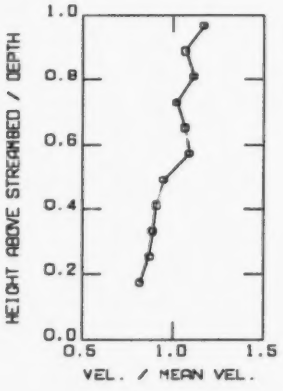
Time	Height above bed (ft)	Velocity (ft/s)
1115	1.0	6.81
1115	2.0	7.43
1115	3.0	9.46
1115	4.0	10.36
1115	5.0	12.95



February 17, 1982 File No.: 2.1

Depth: 6.3 ft
Station: 143
Stream discharge: 15,000 cubic feet per second
Mean velocity: 13.26 ft/s

Time	Height above bed (ft)	Velocity (ft/s)
1250	1.1	10.88
1252	1.6	11.57
1254	2.1	11.82
1256	2.6	12.09
1258	3.1	12.65
1300	3.6	14.50
1302	4.1	14.18
1304	4.6	13.59
1306	5.1	14.83
1308	5.6	14.18
1310	6.1	15.53

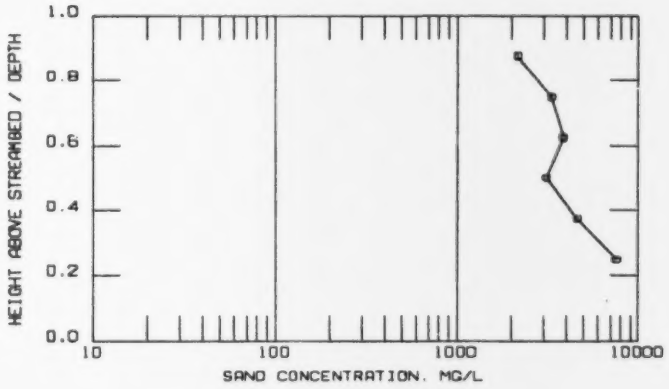


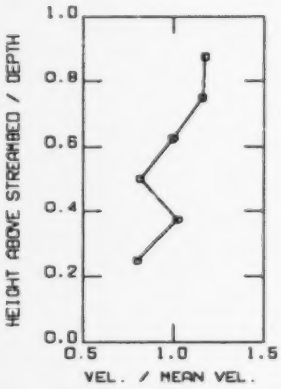
14242580 - Toutle River at Tower Road near Silver Lake, WA

February 24, 1982 File No.: 3.1

Depth: 4.0 ft
Station: 137
Stream discharge: 5,470 cubic feet per second
Mean velocity: 10.86 ft/s

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Pct finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Concentration, mg/L Coarser than 0.062
1248	1.0	8.71	10500	28	3.00	2940	7560
1250	1.5	11.14	7540	39	1.67	2940	4600
1252	2.0	8.89	6000	48	1.00	2880	3120
1254	2.5	10.88	6760	43	0.60	2910	3850
1256	3.0	12.65	6030	45	0.33	2710	3320
1258	3.5	12.79	5010	57	0.14	2860	2150
Z1						0.017	0.344

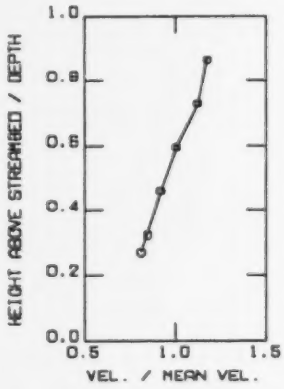




February 24, 1982 File No.: 3.2

Depth: 3.7 ft
Stream discharge: 5,470 cubic feet per second
Station: 137
Mean velocity: 10.27 ft/s

Time	Height above bed (ft)	Velocity (ft/s)
1302	1.0	8.37
1303	1.2	8.71
1304	1.7	9.46
1306	2.2	10.36
1307	2.7	11.57
1308	3.2	12.09



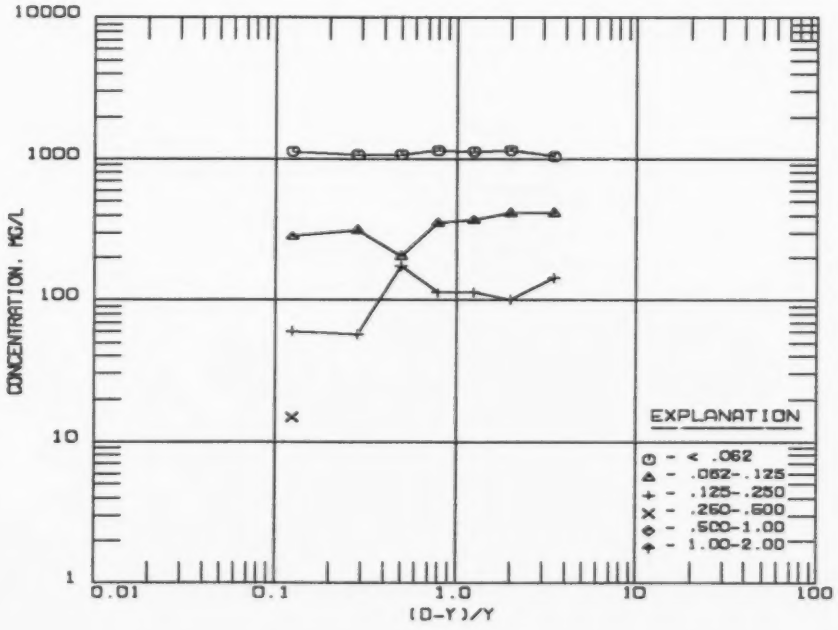
14242580 - Toutle River at Tower Road near Silver Lake, WA

June 8, 1982 Fil. No.: 4.1

Depth: 1.8 ft
Station: 70
Water temperature: 15.5 degrees C
Stream discharge: 1,320 cubic feet per second
Mean velocity: 2.66 ft/s
Water-surface slope: 0.00276

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1307	0.4	—	1610	65	91	100			
1303	0.6	2.86	1680	69	94	100			
1301	0.8	2.86	1620	70	93	100			
1259	1.0	2.92	1610	71	93	100			
1257	1.2	2.68	1460	74	88	100			
1255	1.4	2.44	1440	74	96	100			
1252	1.6	1.92	1490	76	95	99	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1307	3.50	1050	419	145				564
1303	2.00	1160	420	101				521
1301	1.25	1130	373	113				486
1259	0.80	1140	354	113				467
1257	0.50	1080	204	175				380
1255	0.29	1070	317	58				374
1252	0.12	1130	283	60	15			358
Z1		-0.003	0.149	0.238				0.150



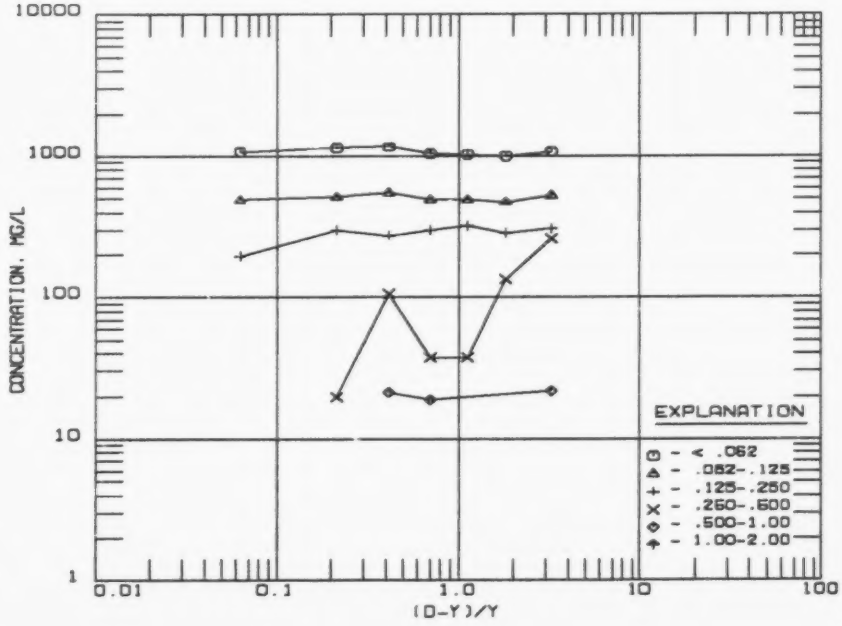
14242580 - Toutle River at Tower Road near Silver Lake, WA

June 8, 1982 File No.: 4.2

Depth: 1.7 ft
Station: 136
Water temperature: 15.5 degrees C
Stream discharge: 1,320 cubic feet per second
Mean velocity: 4.47 ft/s
Water-surface slope: 0.00276

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1332	0.4	--	2190	49	73	87	99	100	
1330	0.6	4.07	1900	53	78	93	100		
1329	0.8	4.26	1880	55	81	98	100		
1327	1.0	4.16	1890	55	81	97	99	100	
1323	1.2	4.46	2120	55	81	94	99	100	
1321	1.4	4.65	1980	58	84	99	100		
1319	1.6	5.55	1770	61	89	100			

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1332	3.25	1070	526	307	263	22		1120
1330	1.83	1010	475	285	133			893
1329	1.13	1030	489	320	38			846
1327	0.70	1040	491	302	38	19		850
1323	0.42	1170	551	276	106	21		954
1321	0.21	1150	515	297	20			832
1319	0.06	1080	496	195				690
Z1		-0.020	-0.003	0.096	0.745	0.034		0.089



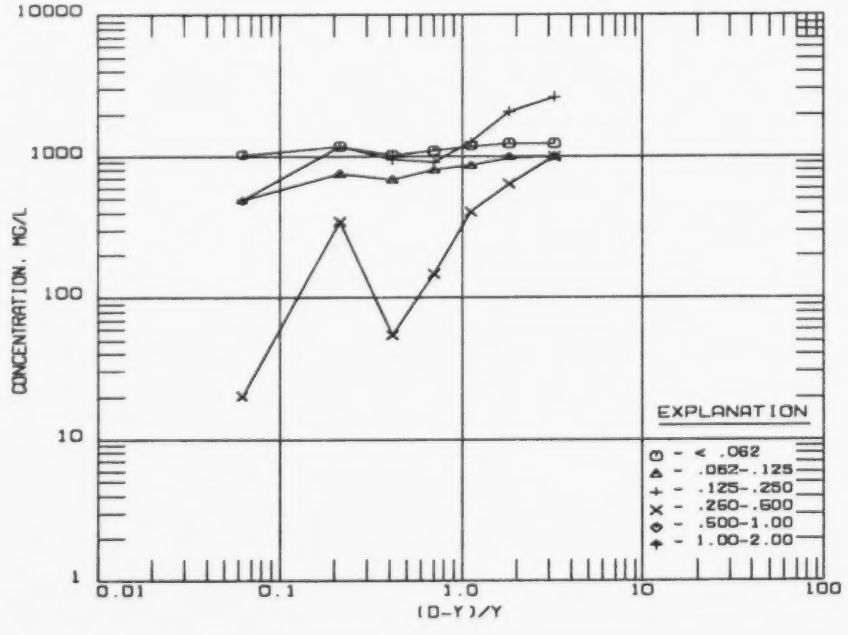
14242580 - Toutle River at Tower Road near Silver Lake, WA

June 8, 1982 File No.: 4.3

Depth: 1.7 ft
Station: 162
Water temperature: 15.5 degrees C
Stream discharge: 1,320 cubic feet per second
Mean velocity: 8.18 ft/s
Water-surface slope: 0.00276

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1357	0.4	--	5870	21	38	83	100		
1356	0.6	7.11	4940	25	45	87	100		
1353	0.8	7.78	3730	32	55	89	100		
1350	1.0	7.97	2960	37	64	95	100		
1348	1.2	7.97	2720	38	63	98	100		
1346	1.4	8.17	3460	34	56	90	100		
1345	1.6	10.88	2030	51	75	99	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1357	3.25	1230	998	2640	998			4640
1356	1.83	1240	988	2070	642			3700
1353	1.13	1190	858	1270	410			2540
1350	0.70	1100	799	918	148			1860
1348	0.42	1030	680	952	54			1690
[illegible]	0.21	1180	761	1180	346			2280
1345	0.06	1040	487	487	20			995
Z1		0.043	0.174	0.377	0.878			0.347



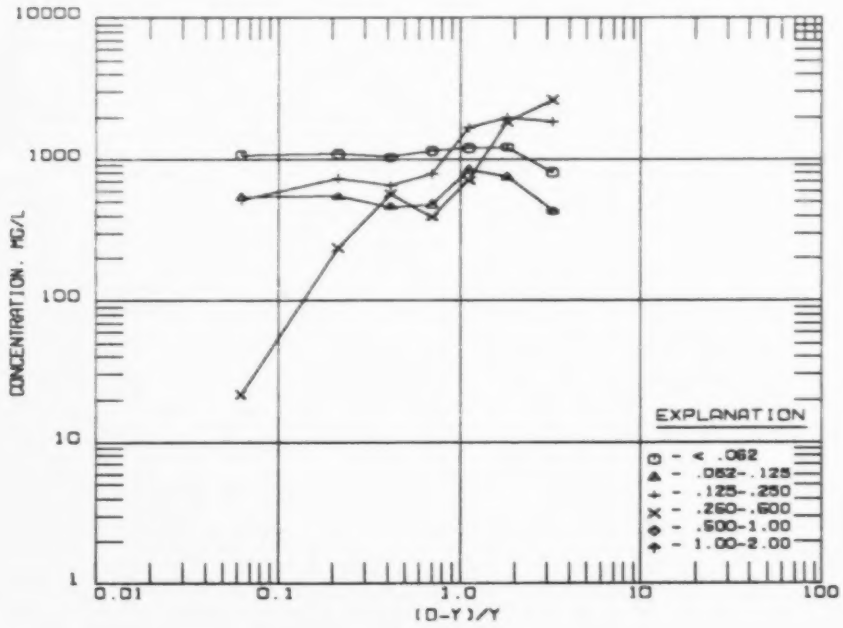
14242580 - Toutle River at Tower Road near Silver Lake, WA

June 8, 1982 File No.: 4.4

Depth: 1.7 ft
Station: 181
Water temperature: 15.5 degrees C
Mean velocity: 8.36 ft/s
Stream discharge: 1,320 cubic feet per second
Water-surface slope: 0.00276

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1421	0.4	--	6180	13	20	50	93	100	
1420	0.6	7.43	5820	21	34	68	100		
1418	0.8	7.78	4440	27	46	84	100		
1415	1.0	8.54	2810	41	58	86	100		
1414	1.2	8.17	2730	38	55	79	100		
1412	1.4	8.17	2610	42	63	91	100		
1411	1.6	10.88	2160	50	75	99	100		

		Concentration, in mg/L, of size class, in mm					
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1421	3.25	803	433	1850	2660	433		5380
1420	1.83	1220	757	1980	1860			4600
1418	1.13	1200	844	1690	710			3240
1415	0.70	1150	478	787	393			1660
1414	0.42	1040	464	655	573			1690
1412	0.21	1100	548	731	235			1510
1411	0.06	1080	540	518	22			1080
Z1		-0.027	0.028	0.375	1.136			0.427



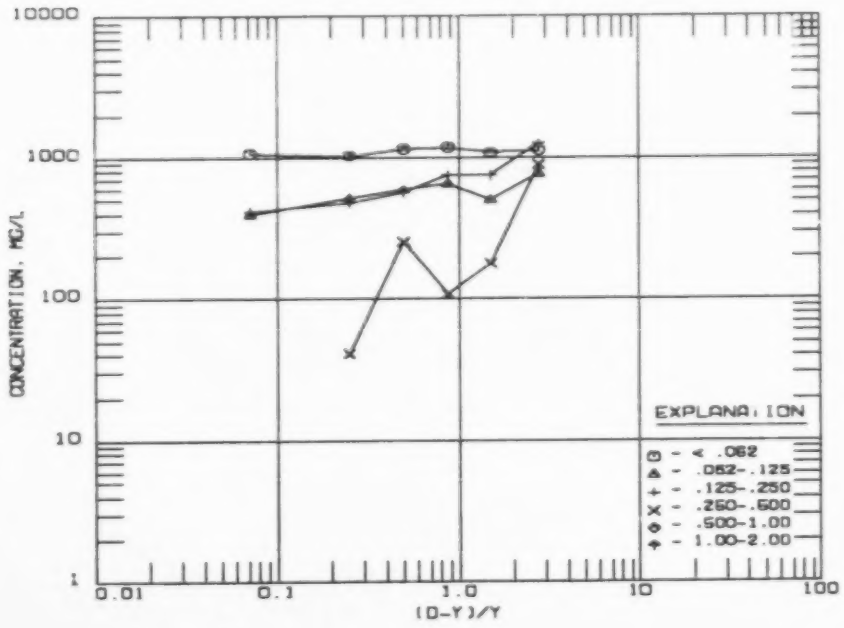
14242580 - Toutle River at Tower Road near Silver Lake, WA

June 8, 1982 File No.: 4.5

Depth: 1.5 ft
Station: 204
Water temperature: 15.5 degrees C
Stream discharge: 1,320 cubic feet per second
Mean velocity: 6.63 ft/s
Water-surface slope: 0.00276

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1442	0.4	--	4040	28	47	78	100		
1441	0.6	6.06	2530	43	63	93	100		
1438	0.8	6.29	2700	44	68	96	100		
1437	1.0	6.54	2560	45	68	90	100		
1435	1.2	6.67	2070	50	75	98	100		
1432	1.4	7.97	1880	57	78	100			

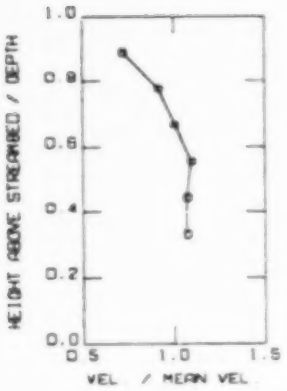
		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1442	2.75	1130	768	1250	889			2910
1441	1.50	1090	506	759	177			1440
1438	0.88	1190	648	756	108			1510
1437	0.50	1150	589	563	256			1410
1435	0.25	1040	518	476	41			1040
1432	0.07	1070	395	414				808
Z1		0.019	0.145	0.286	0.995			0.302



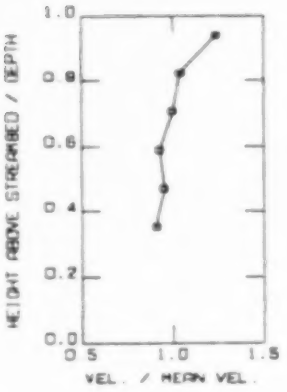
14242580 - Toutle River at Tower Road near Silver Lake, WA

June 8, 1982 File Nos. 4.1 - 4.5

Velocity Profiles



4.1



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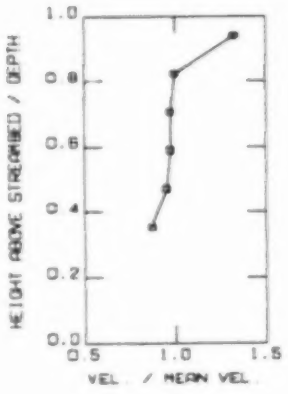
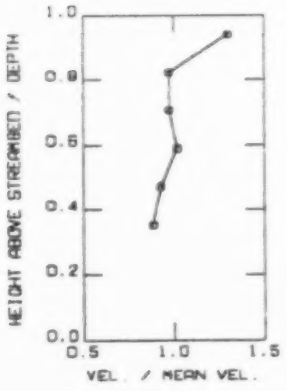


4.3



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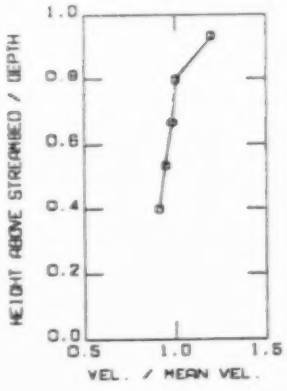


4.5

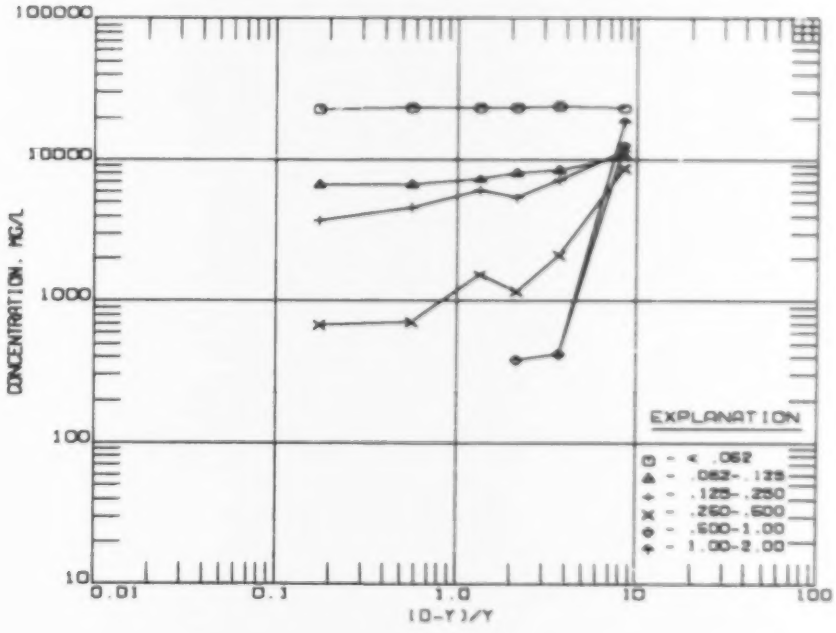
14242580 - Toutle River at Tower Road near Silver Lake, WA

December 3, 1982 File No.: 5.1

Depth: 4.7 ft
Water temperature: 10.0 degrees C
Stream discharge: 11,900 cubic feet per second
Water-surface slope: 0.00379

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm					
				0.062	0.125	0.250	0.500	1.00	2.00
1108	0.5	--	96400	24	35	47	56	69	88
1115	1.0	--	42400	56	76	93	98	99	100
1120	1.5	--	38600	61	82	96	99	100	
1122	2.0	--	38300	61	80	96	100		
1129	3.0	--	35300	66	85	98	100		
1135	4.0	--	33800	67	87	98	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1108	8.40	23100	10600	11600	8680	12500	18300	73300
1115	3.70	23700	8480	7210	2120	424	424	18700
1120	2.13	23500	8110	5700	1160	386		15100
1122	1.35	23400	7280	6130	1530			14900
1129	0.57	23300	6710	4590	706			12000
1135	0.17	22600	6760	3720	676			11200
Z1		0.007	0.114	0.269	0.602	2.662		0.405

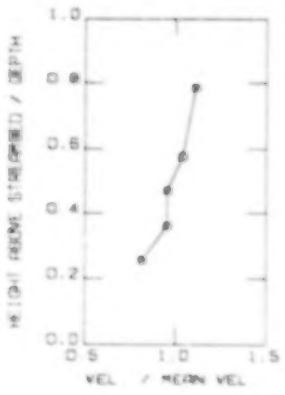


14242580 - Toutle River at Tower Road near Silver Lake, WA

December 3, 1982 File No.: 5.2

Depth: 4.7 ft
Stream discharge: 12,400 cubic feet per second
Water temperature: 10.0 degrees C
Mean velocity: 11.35 ft/s
Water-surface slope: 0.00379

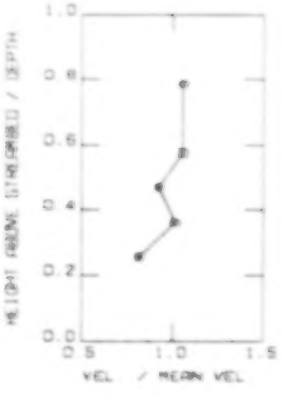
Time	Height above bed (ft)	Velocity (ft/s)
1155	1.2	9.26
1155	1.7	10.88
1155	2.2	10.88
1155	2.7	11.82
1155	3.7	12.65



December 3, 1982 File No.: 5.3

Depth: 4.7 ft
Water temperature: 10.0 degrees C
Stream discharge: 12,400 cubic feet per second
Mean velocity: 10.69 ft/s
Water-surface slope: 0.00379

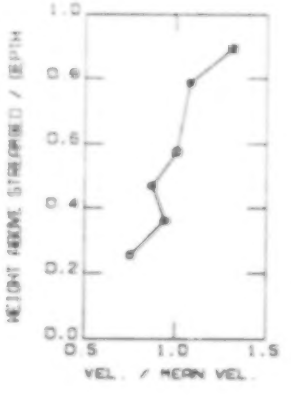
Time	Height above bed (ft)	Velocity (ft/s)
1210	1.2	8.71
1210	1.7	10.88
1210	2.2	9.89
1210	2.7	11.33
1210	3.7	11.33



December 3, 1982 File No.: 5.4

Depth: 4.7 ft
Water temperature: 10.0 degrees C
Stream discharge: 12,300 cubic feet per second
Mean velocity: 9.58 ft/s
Water-surface slope: 0.00379

Time	Height above bed (ft)	Velocity (ft/s)
1240	1.2	7.26
1240	1.7	9.07
1240	2.2	8.38
1240	2.7	9.67
1240	3.7	10.36
1240	4.2	12.65



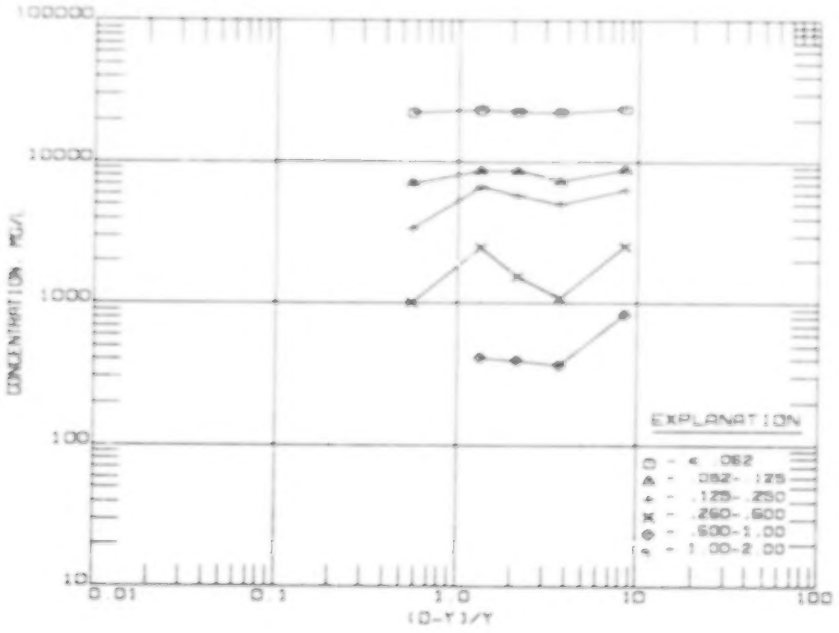
14242580 - Toutle River at Tower Road near Silver Lake, WA

December 3, 1982 File No.: 5.5

Depth: 4.7 ft
Water temperature: 10.0 degrees C
Stream discharge: 12,500 cubic feet per second
Water-surface slope: 0.00385

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1300	0.5	--	42300	56	77	92	98	100	
1313	1.0	--	36400	62	82	96	99	100	
1325	1.5	--	39000	58	80	95	99	100	
1327	2.0	--	41500	56	77	93	99	100	
1330	3.0	--	33800	66	87	97	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1300	8.40	23700	8880	6340	2540	846		18600
1313	3.70	22600	7280	5100	1090	364		13800
1325	2.13	22600	8580	5650	1560	390		16400
1327	1.35	23200	8720	6640	2490	415		18500
1330	0.57	22300	7100	5380	1010			11500
Z1		0.016	0.051	0.173	0.199	0.385		0.123

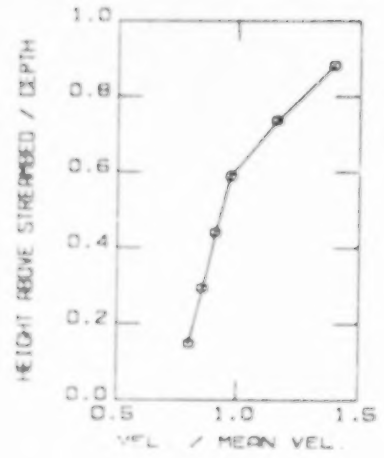


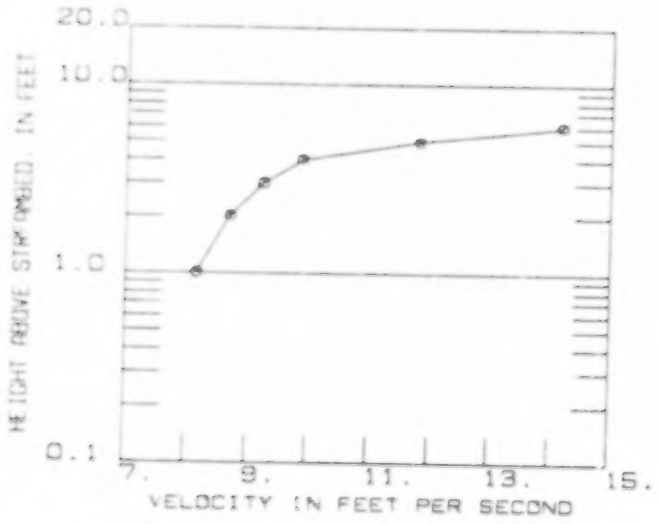
14242580 - Toutle River at Tower Road near Silver Lake, WA

December 16, 1982 File No.: 6.1

Depth: 6.8 ft
Stream discharge: 14,000 cubic feet per second
Mean velocity: 10.17 ft/s
Water-surface slope: 0.00357

Time	Height above bed (ft)	Velocity (ft/s)
1245	1.0	8.17
1245	2.0	8.71
1245	3.0	9.26
1245	4.0	9.89
1245	5.0	11.82
1245	6.0	14.18





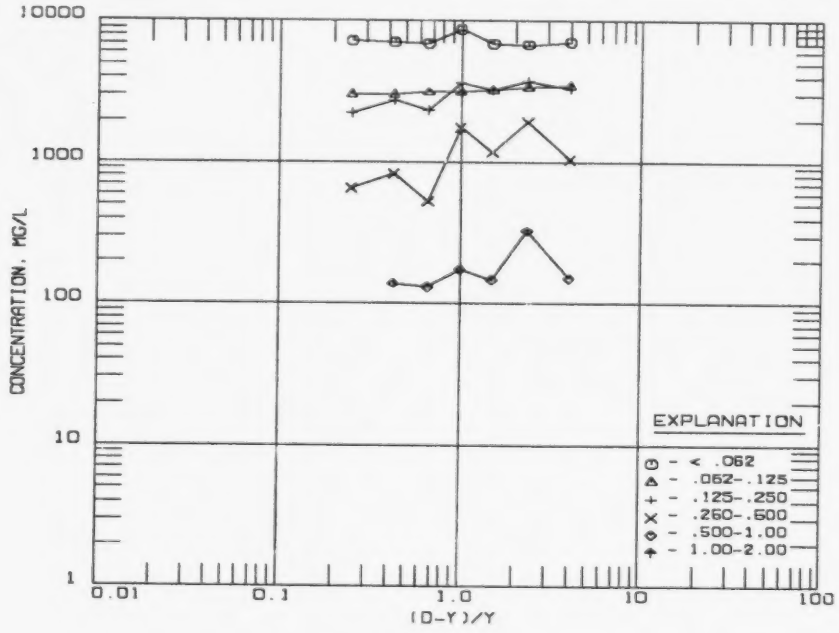
14242530 - Toutle River at Tower Road near Silver Lake, WA

January 7, 1983 File No.: 7.1

Depth: 5.0 ft
Water temperature: 8.0 degrees C
Stream discharge: 12,900 cubic feet per second
Mean velocity: 11.91 ft/s
Water-surface slope: 0.00371

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1330	1.0	9.46	15100	47	70	92	99	100	
1335	1.5	10.88	16300	42	63	86	98	100	
1337	2.0	11.82	14600	47	69	91	99	100	
1340	2.5	11.82	17500	50	68	89	99	100	
1343	3.0	12.31	13100	53	77	95	99	100	
1345	3.5	12.36	13900	51	73	93	99	100	
1355	4.0	12.36	13100	55	78	95	100		
1400	4.5	14.18							

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1330	4.00	7100	3470	3320	1060	151		8000
1335	2.33	6850	3420	3750	1960	326		9450
1337	1.50	6960	3260	3260	1180	148		7840
1340	1.00	8750	3150	3680	1750	175		8750
1343	0.67	6940	3140	2360	524	131		6160
1345	0.43	7090	3060	2780	834	139		6810
1355	0.25	7200	3010	2230	655			5900
1400	0.11							
Z1		-0.009	0.055	0.167	0.306	0.183		0.143



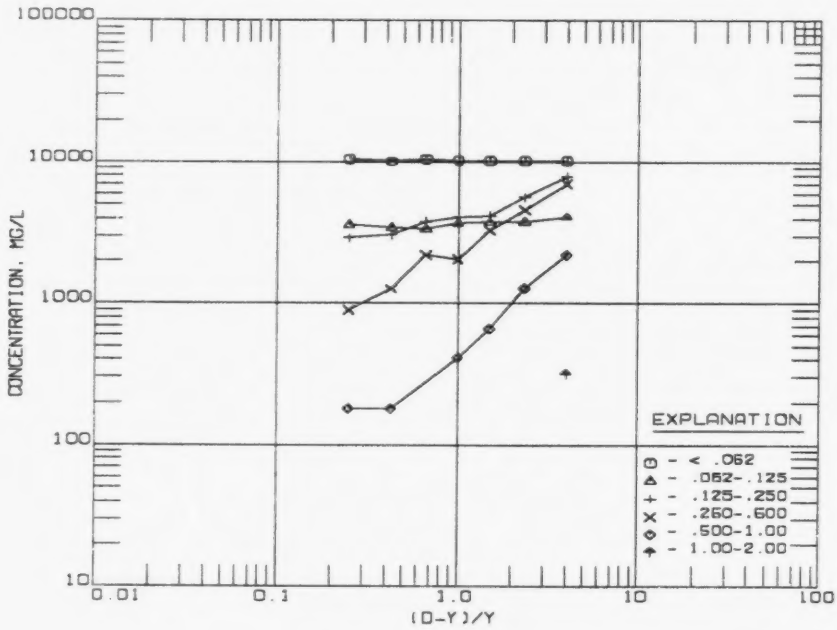
14242580 - Toutle River at Tower Road near Silver Lake, WA

March 10, 1983 File No.: 8.1

Depth: 5.0 ft
Water temperature: 10.0 degrees C
Stream discharge: 8,400 cubic feet per second
Mean velocity: 6.26 ft/s
Water-surface slope: 0.00314

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1120	1.0	6.67	31700	32	45	70	92	99	100
1128	1.5	6.81	25500	40	55	77	95	100	
1131	2.0	6.06	22100	46	63	82	97	100	
1136	2.5	5.84	20600	50	68	88	98	100	
1145	3.0	6.06	19900	53	70	89	100		
1155	3.5	6.41	18100	56	75	92	99	100	
1200	4.0	--	18100	58	78	94	99	100	

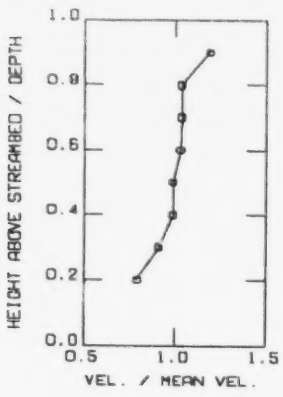
		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1120	4.00	10100	4120	7920	6970	2220	317	21600
1128	2.33	10200	3820	5610	4590	1280		15300
1131	1.50	10200	3760	4200	3320	663		11900
1136	1.00	10300	3710	4120	2060	412		10300
1145	0.67	10500	3380	3780	2190			9350
1155	0.43	10100	3440	3080	1270	181		7960
1200	0.25	10500	3620	2900	905	181		7600
Z1		-0.010	0.056	0.347	0.729	0.962		0.374



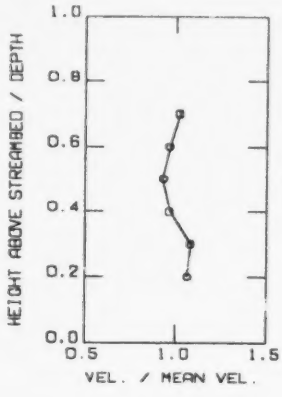
14242580 - Toutle River at Tower Road near Silver Lake, WA

Velocity Profiles

January 7, 1983 File No. 7.1



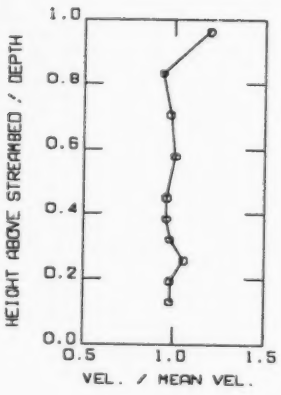
March 10, 1983 File No. 8.1



March 30, 1983 File No.: 9.1

Depth: 7.8 ft
Stream discharge: 7,120 cubic feet per second
Mean velocity: 7.90 ft/s
Water-surface slope: 0.00239

Time	Height above bed (ft)	Velocity (ft/s)
1235	1.0	7.78
1235	1.5	7.78
1235	2.0	8.37
1235	2.5	7.78
1235	3.0	7.60
1235	3.5	7.60
1235	4.5	7.97
1235	5.5	7.78
1235	6.5	7.43
1235	7.5	9.46



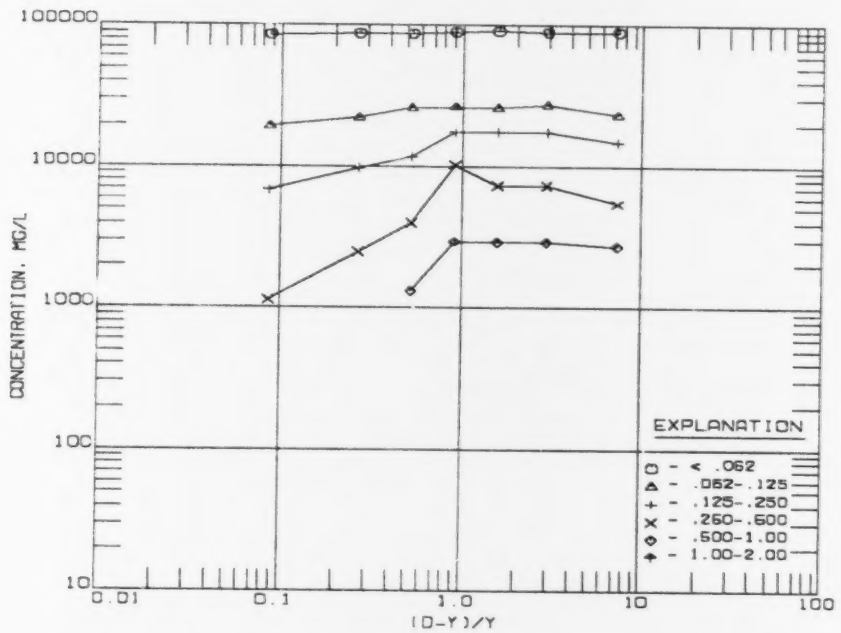
14242580 - Toutle River at Tower Road near Silver Lake, WA

November 3, 1983 File No.: 10.1

Depth: 7.5 ft
Stream discharge: 8,040 cubic feet per second
Water temperature: 12.8 degrees C
Water-surface slope: 0.00346

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1326	0.9	--	137000	66	83	94	98	100	
1340	1.9	--	146000	62	81	93	98	100	
1343	2.9	--	146000	63	81	93	98	100	
1352	3.9	--	148000	61	79	91	98	100	
1402	4.9	--	132000	67	87	96	99	100	
1406	5.9	--	123000	72	90	98	100		
1410	6.9	--	113000	76	93	99	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1326	7.33	90400	23300	15100	5480	2740		46600
1340	2.95	90500	27700	17500	7300	2920		55500
1343	1.59	92000	26300	17500	7300	2920		54000
1352	0.92	90300	26600	17800	10400	2960		57700
1402	0.53	88400	26400	11900	3960	1320		43600
1406	0.27	88600	22100	9840	2460			34400
1410	0.09	85900	19200	6780	1130			27100
Z1		0.012	0.055	0.206	0.398	0.204		0.146



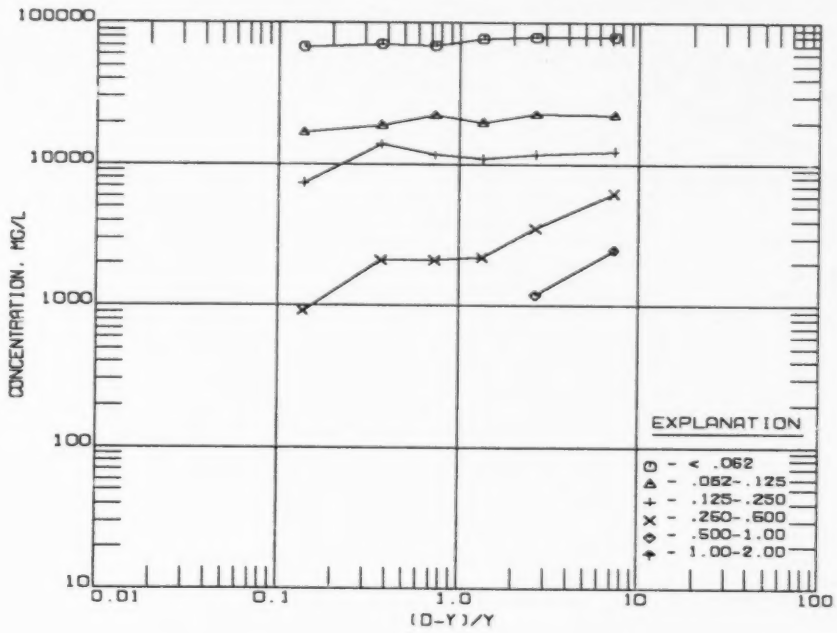
14242580 - Toutle River at Tower Road near Silver Lake, WA

November 3, 1983 File No.: 10.2

Depth: 13.2 ft
Stream discharge: 7,790 cubic feet per second
Water temperature: 12.8 degrees C
Water-surface slope: 0.00346

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1429	1.6	--	124000	65	83	93	98	100	
1434	3.6	--	119000	67	86	96	99	100	
1440	5.6	--	111000	70	88	98	100		
1509	7.6	--	106000	66	87	98	100		
1514	9.6	--	106000	67	85	98	100		
1517	11.6	--	92800	73	91	99	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1429	7.25	80600	22300	12400	6200	2480		43400
1434	2.67	79700	22600	11900	3570	1190		39300
1440	1.36	77700	20000	11100	2220			33300
1509	0.74	70000	22300	11700	2120			36000
1514	0.37	71000	19100	13800	2120			35000
1517	0.14	67700	16700	7420	928			25100
Z1		0.049	0.071	0.086	0.431			0.118



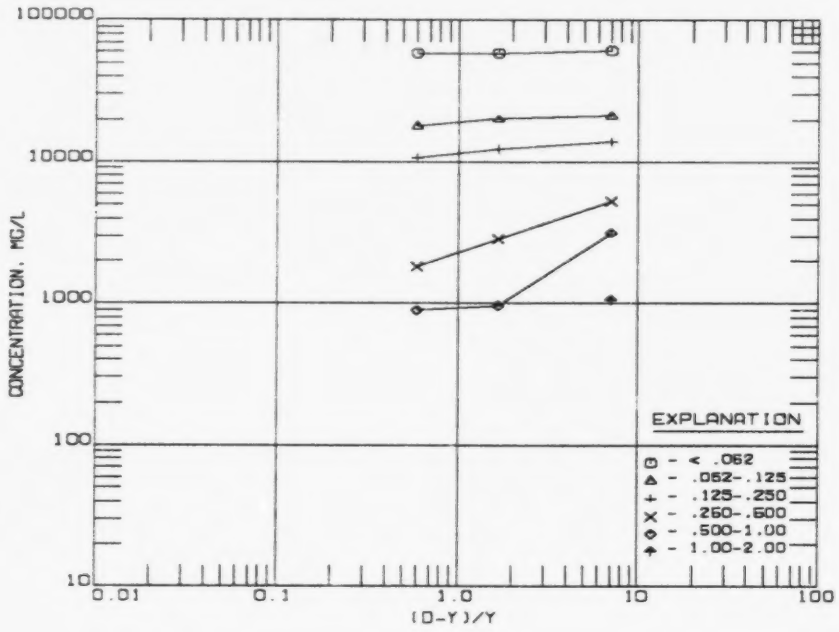
14242580 - Toutle River at Tower Road near Silver Lake, WA

November 3, 1983 File No.: 10.3

Depth: 3.2 ft
Station: midpoint, left third of flow
Water temperature: 12.8 degrees C
Stream discharge: 8,030 cubic feet per second
Water-surface slope: 0.00302

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1602	0.4	--	106000	58	78	91	96	99	100
1606	1.2	--	95600	62	83	96	99	100	
1614	2.0	--	90500	65	85	97	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1602	7.00	61500	21200	13800	5300	3180	1060	44500
1606	1.67	59300	20100	12400	2870	956		36300
1614	0.60	58800	18100	10900	1810	905		31700
Z1		0.018	0.063	0.095	0.437	0.533		0.139



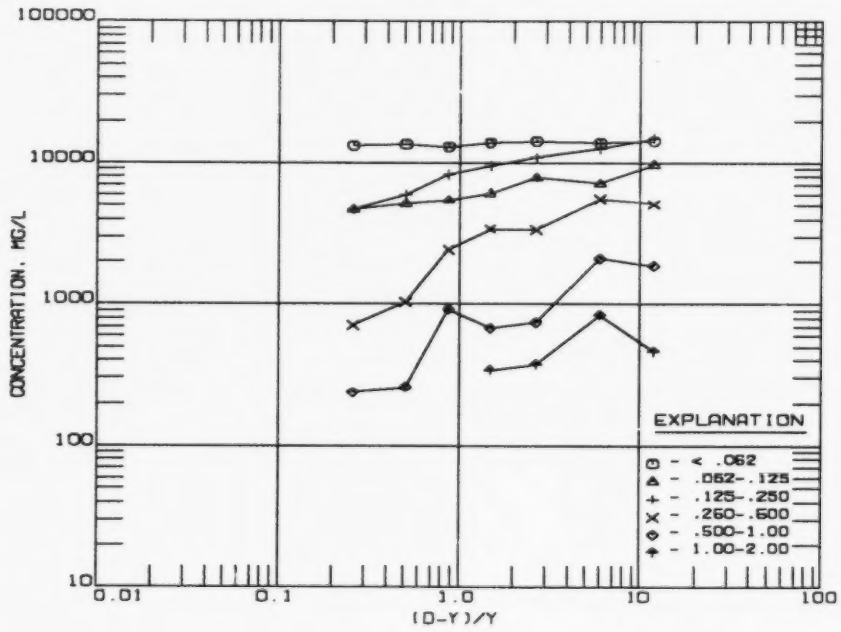
14242580 - Toutle River at Tower Road near Silver Lake, WA

November 4, 1983 File No.: 11.1

Depth: 7.7 ft
Water temperature: 10.0 degrees C
Stream discharge: 5,790 cubic feet per second
Water-surface slope: 0.00288

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1154	0.6	--	46400	31	52	84	95	99	100
1156	1.1	--	42200	33	50	80	93	98	100
1201	2.1	--	37500	38	59	88	97	99	100
1203	3.1	--	34100	41	59	87	97	99	100
1207	4.1	--	30400	43	61	88	96	99	99
1210	5.1	--	26000	52	72	95	99	100	
1212	6.1	--	23700	56	76	96	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1154	11.83	14400	9740	14800	5100	1860	464	32000
1156	6.00	13900	7170	12700	5490	2110	844	28300
1201	2.67	14200	7880	10900	3380	750	375	23200
1203	1.48	14000	6140	9550	3410	682	341	20100
1207	0.88	13100	5470	8210	2430	912		17300
1210	0.51	13500	5200	5980	1040	260		12500
1212	0.26	13300	4740	4740	711	237		10400
Z1		0.022	0.180	0.295	0.538	0.582	0.254	0.300



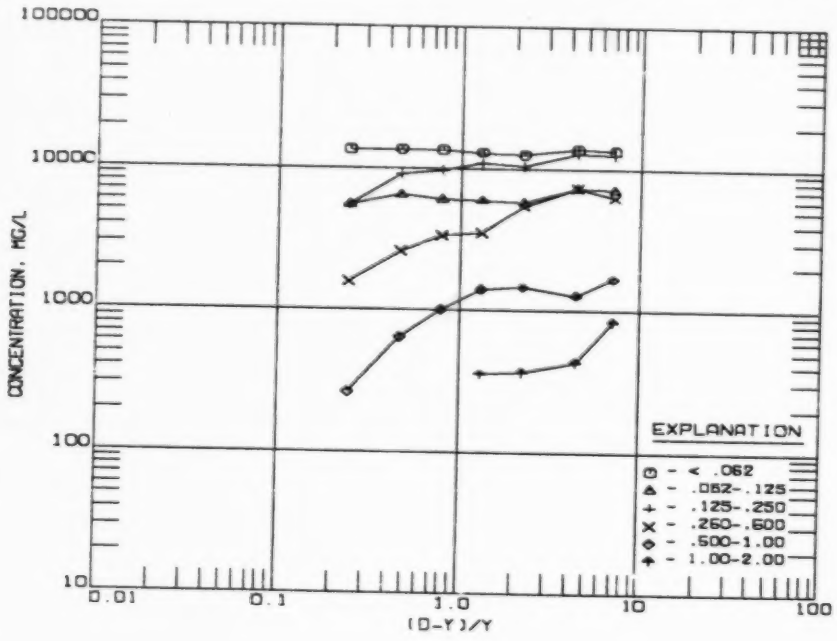
14242580 - Toutle River at Tower Road near Silver Lake, WA

November 4, 1983 File No.: 11.^

Depth: 8.1 ft
Stream discharge: 5,320 cubic feet per second
Water temperature: 10.0 degrees C
Water-surface slope: 0.00288

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1318	1.0	--	42100	32	49	79	94	98	100
1321	1.5	--	43200	32	49	79	96	99	100
1328	2.5	--	36500	35	51	80	95	99	100
1331	3.5	--	35400	37	54	85	95	99	100
1338	4.5	--	33900	40	58	87	97	100	
1340	5.5	--	32600	42	62	90	98	100	
1342	6.5	--	26400	51	72	93	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1318	7.10	13500	7160	12600	6320	1680	842	28600
1321	4.40	13800	7340	13000	7340	1300	432	29400
1328	2.24	12800	5840	10600	5480	1460	365	23700
1331	1.31	13100	6020	11000	3540	1420	354	22300
1338	0.80	13600	6100	9830	3390	1020		20300
1340	0.47	13700	6520	9130	2610	652		18900
1342	0.25	13500	5540	5540	1580	264		12900
Z1		-0.002	0.064	0.211	0.432	0.468	0.472	0.221



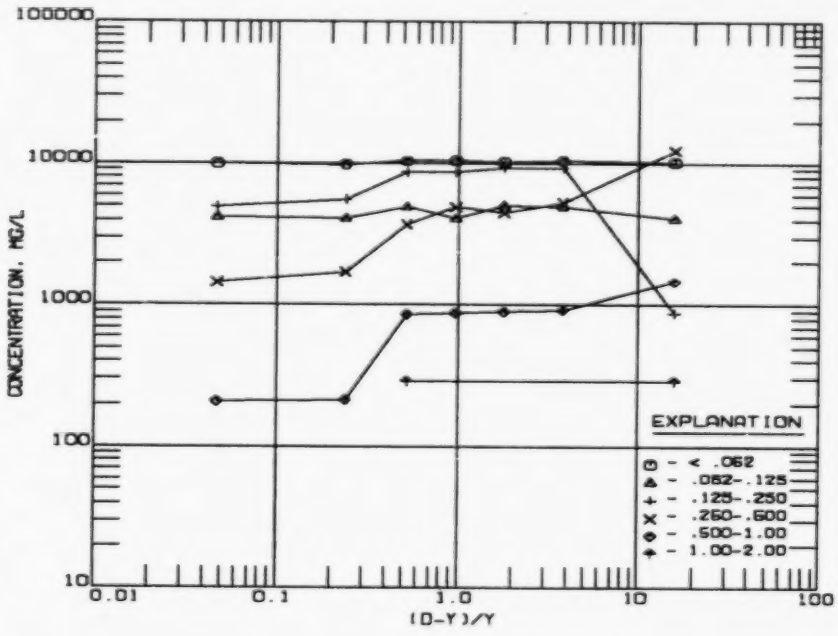
14242580 - Toutle River at Tower Road near Silver Lake, WA

November 17, 1983 File No.: 12.1

Depth: 13.4 ft
Water temperature: 8.0 degrees C
Stream discharge: 10,200 cubic feet per second
Water-surface slope: 0.00301

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1046	0.8	--	29200	35	49	52	94	99	100
1050	2.8	--	30800	34	50	80	97	100	
1053	4.8	--	29900	34	51	82	97	100	
1055	6.8	--	29000	36	50	80	97	100	
1110	8.8	--	28800	36	53	83	96	99	100
1112	10.8	--	21400	46	65	91	99	100	
1114	12.8	--	20700	48	68	92	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1046	15.75	10200	4090	876	12300	1460	292	19000
1050	3.79	10500	4930	9240	5240	924		20300
1053	1.79	10200	5080	9270	4480	897		19700
1055	0.97	10400	4060	8700	4930	870		18600
1110	0.52	10400	4900	8640	3740	864	288	18400
1112	0.24	9840	4070	5560	1710	214		11600
1114	0.05	9940	4140	4970	1450	207		10800
Z1		0.007	0.013	-0.190	0.365	0.361		0.117



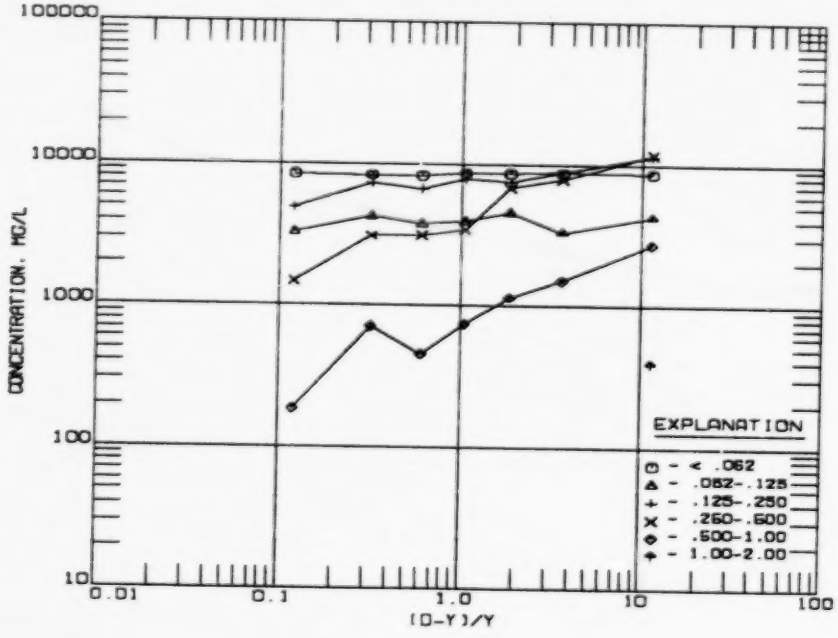
14242580 - Toutle River at Tower Road near Silver Lake, WA

November 17, 1983 File No.: 12.2

Depth: 14.8 ft
Water temperature: 8.0 degrees C
Stream discharge: 9,710 cubic feet per second
Water-surface slope: 0.00293

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1243	1.2	--	39300	22	33	62	92	99	100
1246	3.2	--	30300	29	40	69	95	100	
1248	5.2	--	28800	30	46	72	96	100	
1250	7.2	--	24800	35	51	83	97	100	
1255	9.2	--	22500	37	54	84	98	100	
1256	11.2	--	23900	35	53	84	97	100	
1258	13.2	--	18400	46	64	91	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1243	11.33	8650	4320	11400	11800	2750	393	30700
1246	3.63	8790	3330	6790	7880	1520		21500
1248	1.85	8640	4610	7490	6910	1150		20200
1250	1.06	8680	3970	7940	3470	744		16100
1255	0.61	8320	3820	6750	3150	450		14200
1256	0.32	8360	4300	7410	3110	717		15500
1258	0.12	8460	3310	4970	1470	184		9940
Z1		0.009	0.028	0.155	0.453	0.545		0.227



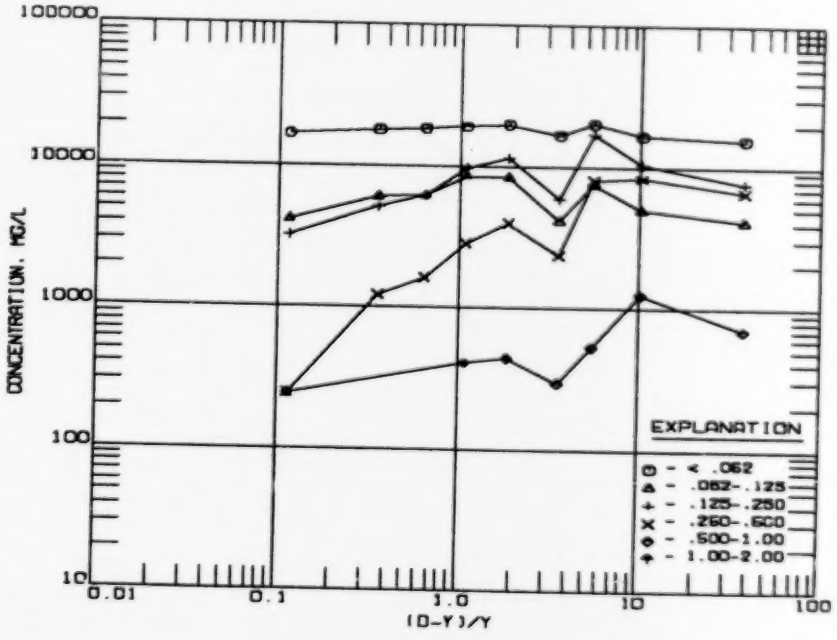
14242580 - Toutle River at Tower Road near Silver Lake, WA

November 2, 1984 File No.: 13.1

Depth: 15.5 ft
Water temperature: 9.3 degrees C
Stream discharge: 8,530 cubic feet per second
Water-surface slope: 0.00322

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1320	0.4	--	35100	45	57	79	98	100	
1325	1.4	--	41900	40	52	77	97	100	
1328	2.4	--	53400	38	52	84	99	100	
1332	3.4	--	29600	57	71	91	99	100	
1334	5.4	--	44500	45	64	90	99	100	
1338	7.4	--	40800	47	68	92	99	100	
1341	9.4	--	32600	57	76	95	100		
1344	11.4	--	30400	59	79	96	100		
1347	13.9	--	24700	68	85	98	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1320	37.75	15800	4210	7720	6670	702		19300
1325	10.07	16800	5030	10500	8380	1260		25100
1328	5.46	20300	7480	17100	8010	534		33100
1332	3.56	16900	4140	5920	2370	296		12700
1334	1.87	20000	8460	11600	4000	445		24500
1338	1.09	19200	8570	9790	2860	408		21600
1341	0.65	18600	6190	6190	1630			14000
1344	0.36	17900	6080	5170	1220			12500
1347	0.12	16800	4200	3210	247	247		7900
Z1		-0.012	-0.024	0.174	0.561	0.222		0.169

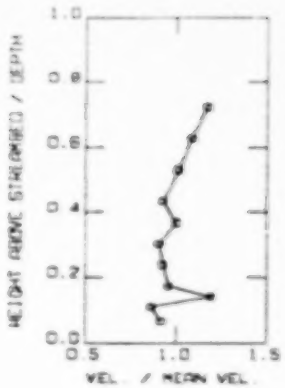


14242580 - Toutle River at Tower Road near Silver Lake, WA

November 2, 1984 File No.: 13.2

Depth: 15.5 ft
Stream discharge: 8,670 cubic feet per second
Mean velocity: 9.36 ft/s
Water-surface slope: 0.00327

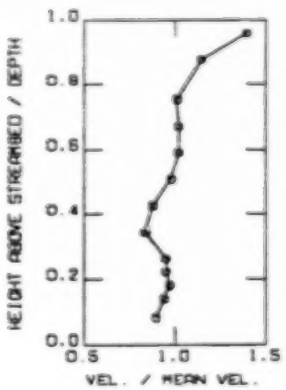
Time	Height above bed (ft)	Velocity (ft/s)
1350	1.0	8.60
1350	1.7	8.10
1350	2.2	11.20
1350	2.7	9.00
1350	3.7	8.70
1350	4.7	8.50
1350	5.7	9.40
1350	6.7	8.70
1350	8.2	9.50
1350	9.7	10.20
1350	11.2	11.00



November 2, 1984 File No.: 13.3

Depth: 12.2 ft
Stream discharge: 8,780 cubic feet per second
Mean velocity: 9.67 ft/s
Water-surface slope: 0.00327

Time	Height above bed (ft)	Velocity (ft/s)
1400	1.0	8.70
1400	1.7	9.10
1400	2.2	9.40
1400	2.7	9.20
1400	3.2	9.20
1400	4.2	8.10
1400	5.2	8.50
1400	6.2	9.50
1400	7.2	9.90
1400	8.2	9.90
1400	9.2	9.80
1400	10.7	11.10
1400	11.7	13.50

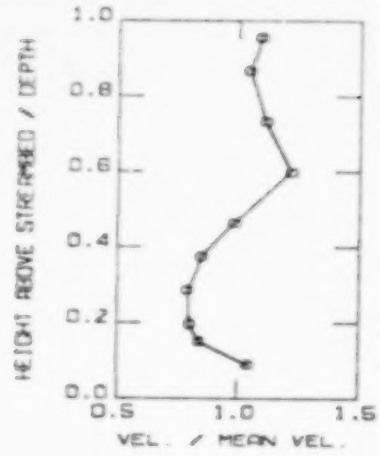


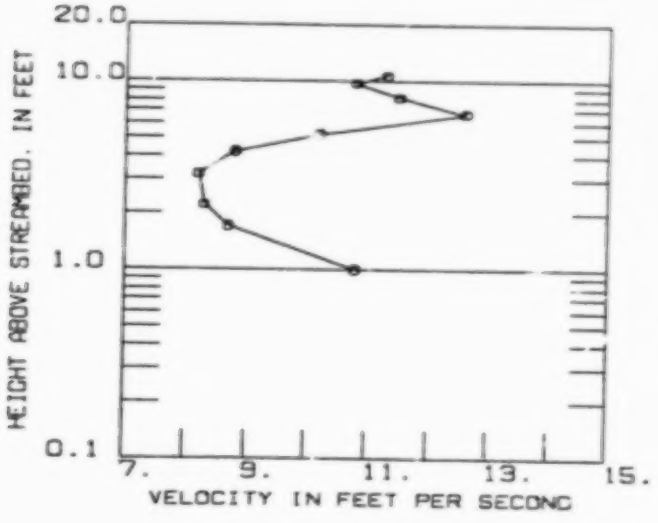
14242580 - Toutle River at Tower Road near Silver Lake, WA

November 2, 1984 File No.: 13.4

Depth: 11.2 ft
Stream discharge: 8,970 cubic feet per second
Mean velocity: 10.34 ft/s
Water-surface slope: 0.00327

Time	Height above bed (ft)	Velocity (ft/s)
1430	1.0	10.80
1430	1.7	8.70
1430	2.2	8.30
1430	3.2	8.20
1430	4.2	8.80
1430	5.2	10.20
1430	6.7	12.60
1430	8.2	11.50
1430	9.7	10.80
1430	10.7	11.30





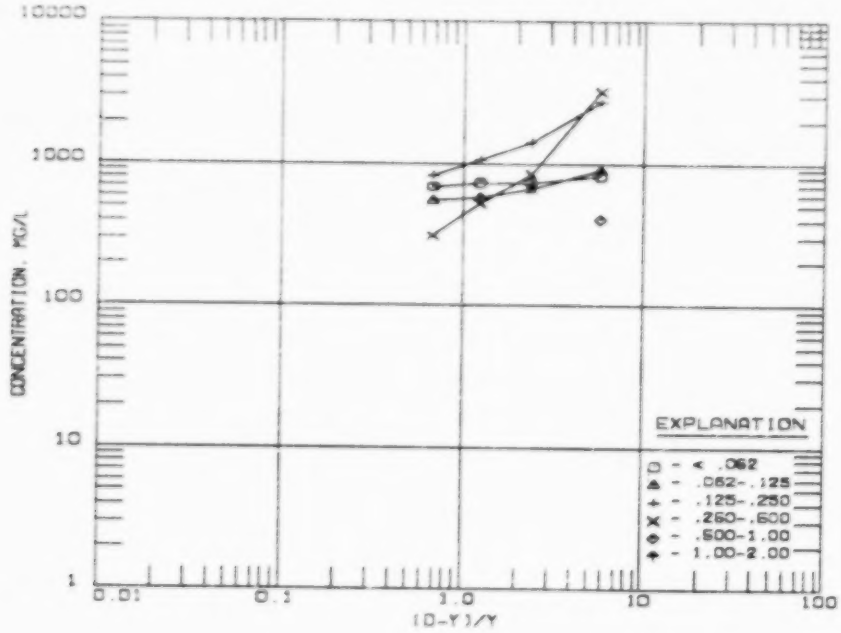
14242580 - Toutle River at Tower Road near Silver Lake, WA

March 22, 1985 File No.: 14.1

Depth: 2.7 ft
Water temperature: 5.5 degrees C
Stream discharge: 1,730 cubic feet per second
Water-surface slope: 0.00239

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1235	0.4	--	8210	10	21	55	95	100	
1237	0.8	--	3690	20	38	77	100		
1240	1.2	--	2920	25	45	82	100		
1245	1.6	--	2390	29	52	87	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1235	5.75	821	903	2790	3280	410		7390
1237	2.38	739	664	1440	849			2950
1240	1.25	730	584	1080	526			2190
1245	0.69	693	550	836	311			1700
Z1		0.075	0.236	0.564	1.095			0.687



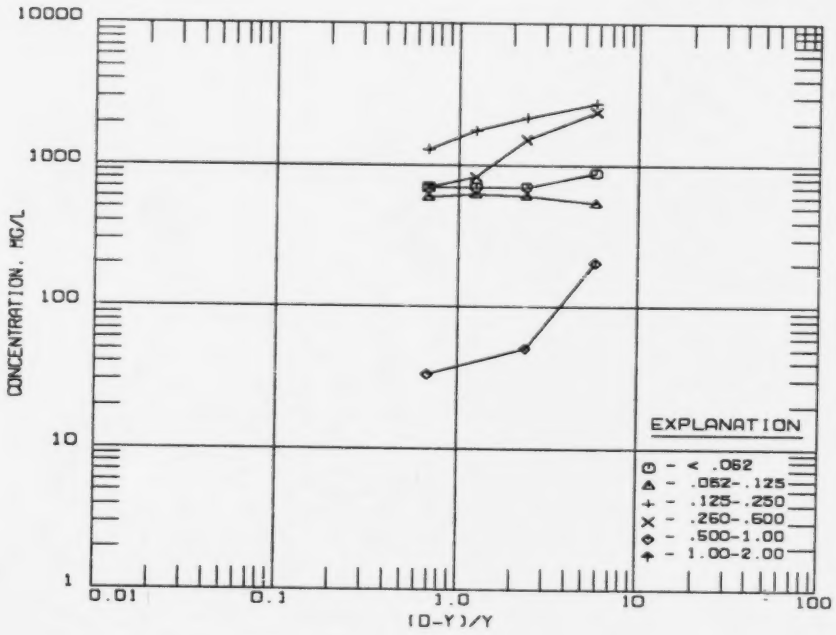
14242580 - Toutle River at Tower Road near Silver Lake, WA

March 22, 1985 File No.: 14.2

Depth: 2.7 ft
Water temperature: 5.3 degrees C
Stream discharge: 1,730 cubic feet per second
Water-surface slope: 0.00239

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1249	0.4	--	6790	13	21	62	97	100	
1255	0.8	--	5070	14	26	69	99	100	
1258	1.2	--	3930	18	34	79	100		
1301	1.6	--	3310	21	39	78	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1249	5.75	883	543	2780	2380	204		5910
1255	2.38	710	608	2180	1520	51		4360
1258	1.25	707	629	1770	825			3220
1301	0.69	695	596	1290	695	33		2610
Z1		0.108	-0.049	0.354	0.613	0.823		0.391



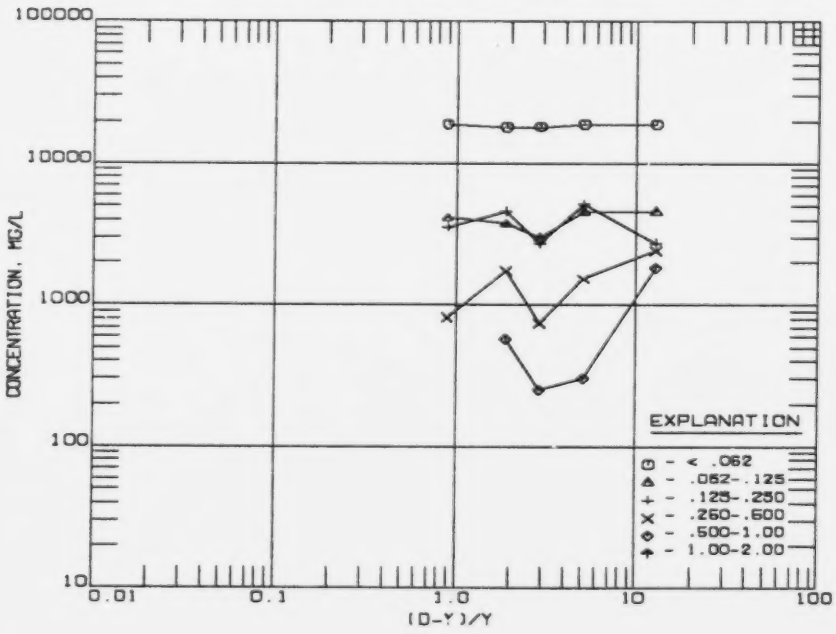
14242580 - Toutle River at Tower Road near Silver Lake, WA

June 7, 1985 File No.: 15.1

Depth: 5.5 ft
Water temperature: 12.1 degrees C
Stream discharge: 9,300 cubic feet per second
Water-surface slope: 0.00556

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1447	0.4	--	30500	62	77	86	94	100	
1450	0.9	--	30600	62	77	94	99	100	
1457	1.4	--	25000	73	85	96	99	100	
1501	1.9	--	28900	63	76	92	98	100	
1504	2.9	--	27500	69	84	97	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1447	12.75	18900	4580	2740	2440	1830		11600
1450	5.11	19000	4590	5200	1530	306		11600
1457	2.93	18200	3000	2750	750	250		6750
1501	1.89	18200	3760	4620	1730	578		10700
1504	0.90	19000	4120	3580	825			8520
Z1		0.005	0.067	-0.075	0.353	0.724		0.118



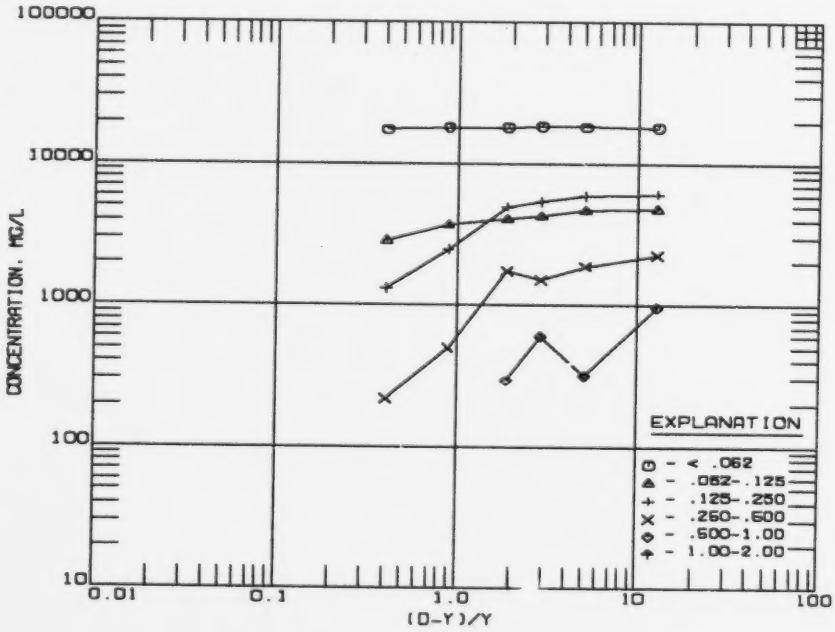
14242580 - Toutle River at Tower Road near Silver Lake, WA

June 7, 1985 File No.: 15.2

Depth: 5.5 ft
Stream discharge: 9,070 cubic feet per second
Water temperature: 12.1 degrees C
Water-surface slope: 0.00556

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1533	0.4	--	32400	56	71	90	97	100	
1536	0.9	--	31500	58	73	92	98	99	100
1539	1.4	--	30300	61	75	93	98	100	
1542	1.9	--	29300	62	76	93	99	100	
1549	2.9	--	24800	73	88	98	100		
1551	3.9	--	21800	80	93	99	100		

		Concentration, in mg/L, of size class, in mm					
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1533	12.75	18100	4860	6160	2270	972		14300
1536	5.11	18300	4720	5980	1890	315	315	13200
1539	2.93	18500	4240	5450	1520	606		11800
1542	1.89	18200	4100	4980	1760	293		11100
1549	0.90	18100	3720	2480	496			6700
1551	0.41	17400	2830	1310	218			4360
Z1		0.011	0.151	0.461	0.690	0.497		0.353



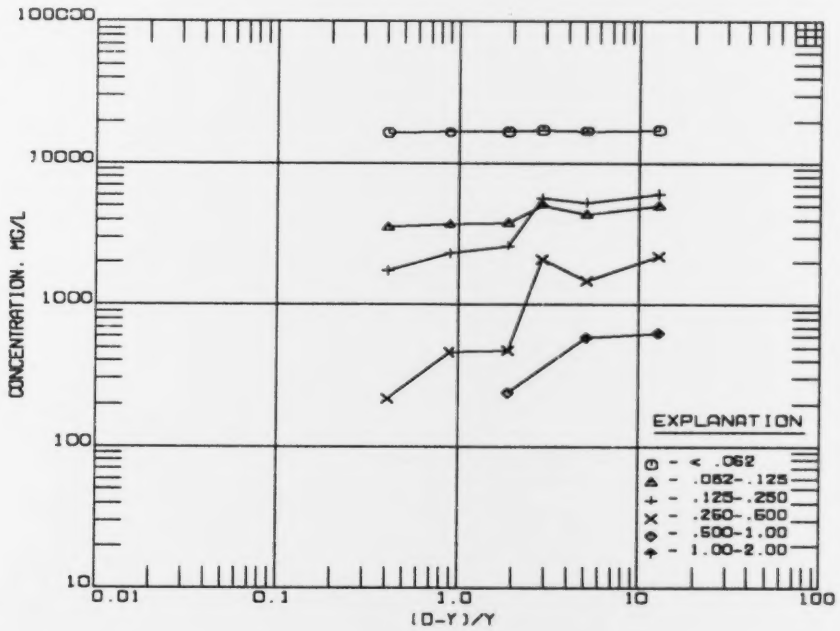
14242580 - Toutle River at Tower Road near Silver Lake, WA

June 7, 1985 File No.: 15.3

Depth: 5.5 ft
Water temperature: 12.1 degrees C
Stream discharge: 8,970 cubic feet per second
Water-surface slope: 0.00556

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm					
				0.062	0.125	0.250	0.500	1.00	2.00
1613	0.4	--	31800	54	70	89	96	98	100
1616	0.9	--	29300	58	73	91	96	98	100
1618	1.4	--	30000	57	74	93	100		
1620	1.9	--	23900	70	86	97	99	100	
1623	2.9	--	23100	72	88	98	100		
1625	3.9	--	21900	75	91	99	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1613	12.75	17200	5090	6040	2230	636	636	14600
1616	5.11	17000	4400	5270	1460	586	586	12300
1618	2.93	17100	5100	5700	2100			12900
1620	1.89	16700	3820	2630	478	239		7170
1623	0.90	16600	3700	2310	462			6470
1625	0.41	16400	3500	1750	219			5480
Z1		0.013	0.115	0.402	0.708	0.519		0.317



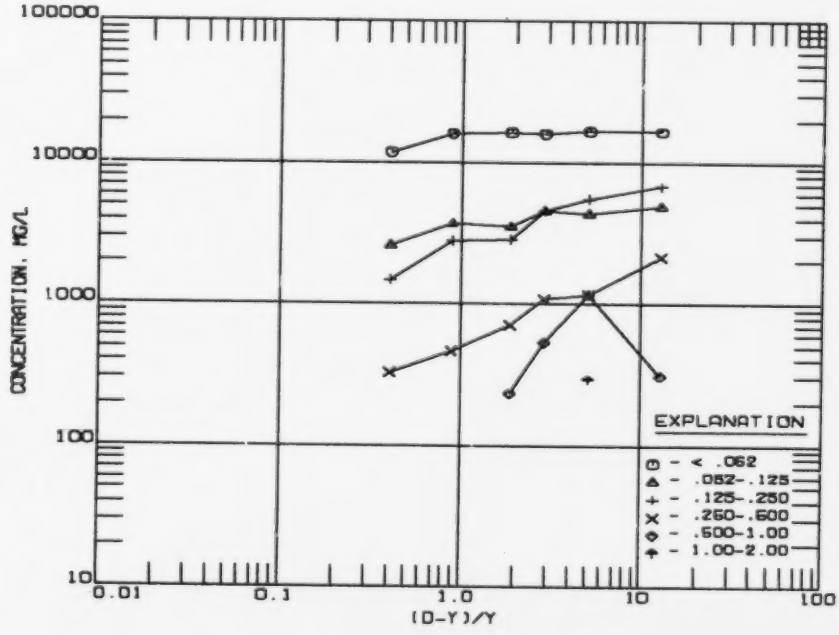
14242580 - Toutle River at Tower Road near Silver Lake, WA

June 7, 1985 File No.: 15.4

Depth: 5.5 ft
Water temperature: 12.1 degrees C
Stream discharge: 8,900 cubic feet per second
Water-surface slope: 0.00556

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1629	0.4	—	30800	54	70	92	99	100	
1633	0.9	—	29300	57	72	91	95	99	100
1635	1.4	—	26900	60	77	94	98	100	
1640	1.9	—	23600	69	84	96	99	100	
1644	2.9	—	23100	70	86	98	100		
1648	3.9	—	16300	73	89	98	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1629	12.75	16600	4930	6780	2160	308		14200
1633	5.11	16700	4400	5570	1170	1170	293	12600
1635	2.93	16100	4570	4570	1080	538		10800
1640	1.89	16300	3540	2830	708	236		7320
1644	0.90	16200	3700	2770	462			6930
1648	0.41	11900	2610	1470	326			4400
Z1		0.079	0.172	0.442	0.554	0.104		0.346



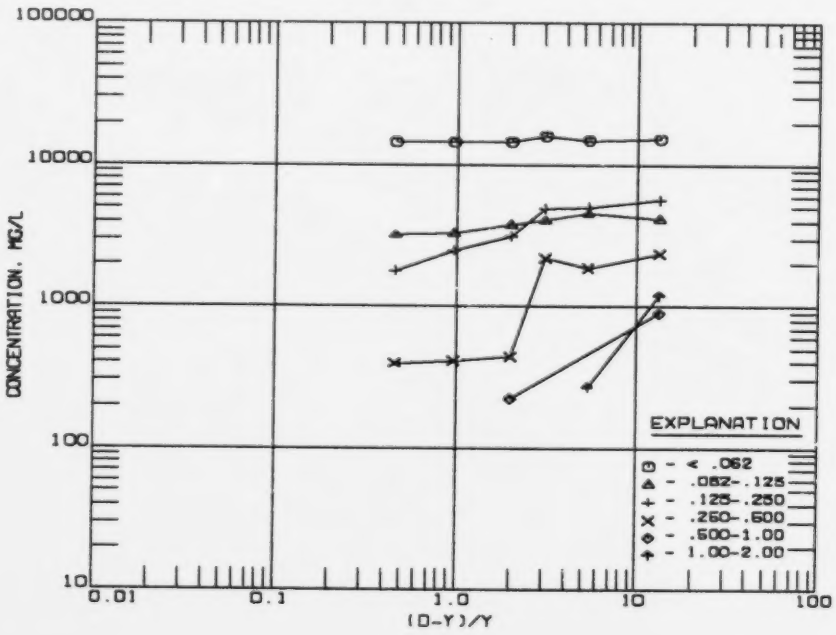
14242580 - Toutle River at Tower Road near Silver Lake, WA

June 7, 1985 File No.: 15.5

Depth: 5.7 ft
Water temperature: 12.1 degrees C
Stream discharge: 8,750 cubic feet per second
Water-surface slope: 0.00556

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1718	0.4	--	29700	52	66	85	9[illegible]	96	100
1724	0.9	--	26800	56	73	92	99	99	100
1726	1.4	--	27400	59	74	92	100		
1732	1.9	--	22300	66	83	97	99	100	
1734	2.9	--	20700	70	86	98	100		
1736	3.9	--	19900	73	89	98	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1718	13.25	15400	4160	5640	2380	891	1190	14300
1724	5.33	15000	4560	5090	1880		[illegible]68	11800
1726	3.07	16200	4110	4930	2190			11200
1732	2.00	14700	3790	3120	446	223		7580
1734	0.97	14500	3310	2480	414			6210
1736	0.46	14500	3180	1790	398			5370
Z1		0.022	0.102	0.366	0.645			0.316



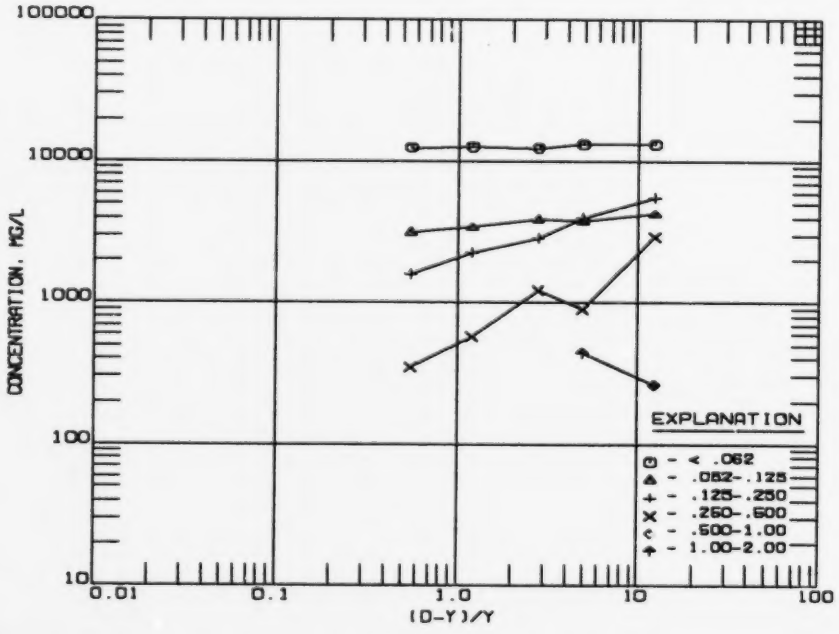
14242580 - Toutle River at Tower Road near Silver Lake, WA

June 7, 1985 File No.: 15.6

Depth: 5.3 ft
Water temperature: 12.1 degrees C
Stream discharge: 8,460 cubic feet per second
Water-surface slope: 0.00556

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1826	0.4	—	26400	50	66	87	98	99	100
1829	0.9	—	22300	59	76	94	98	98	100
1831	1.4	—	20300	61	80	94	100		
1835	2.4	—	19000	67	85	97	100		
1838	3.4	—	17600	71	89	98	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1826	12.25	13200	4220	5540	2900	264	264	13200
1829	4.89	13200	3790	4010	892		446	9140
1831	2.79	12400	3860	2840	1220			7920
1835	1.21	12700	3420	2280	570			6270
1838	0.56	12500	3170	1580	352			5100
Z1		0.018	0.091	0.404	0.630			0.302



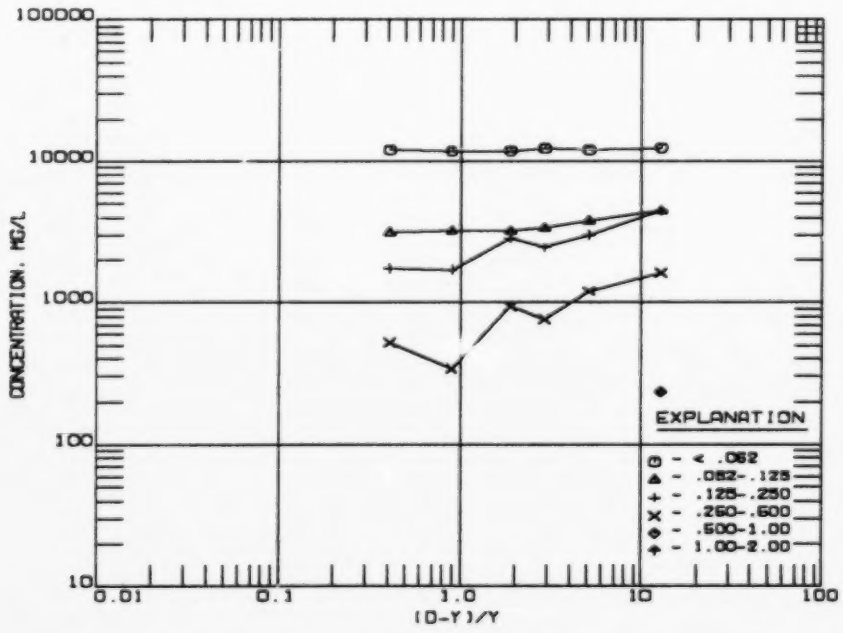
14242580 - Toutle River at Tower Road near Silver Lake, WA

June 7, 1985 File No.: 15.7

Depth: 5.5 ft
Water temperature: 12.1 degrees C
Stream discharge: 8,430 cubic feet per second
Water-surface slope: 0.00556

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1845	0.4	--	23400	53	72	91	98	99	100
1848	0.9	--	20100	60	79	94	100		
1851	1.4	--	18900	65	83	96	100		
1854	1.9	--	18900	63	80	95	100		
1856	2.9	--	17000	69	88	98	100		
1859	3.9	--	17400	69	87	97	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1845	12.75	12400	4450	4450	1640	234	234	11000
1848	5.11	12100	3820	3020	1210			8040
1851	.93	12300	3400	2460	756			6620
1854	.89	11900	3210	2840	945			6990
1856	0.90	11700	3230	1700	340			5270
1859	0.41	12000	3130	1740	522			5390
Z1		0.012	0.101	0.279	0.405			0.211

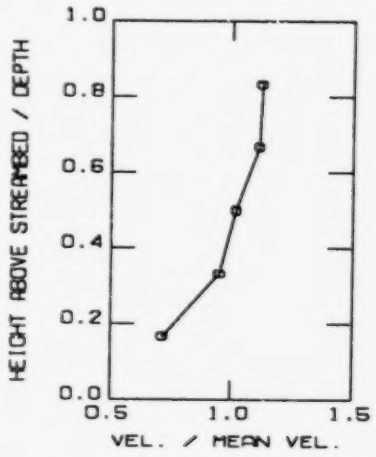


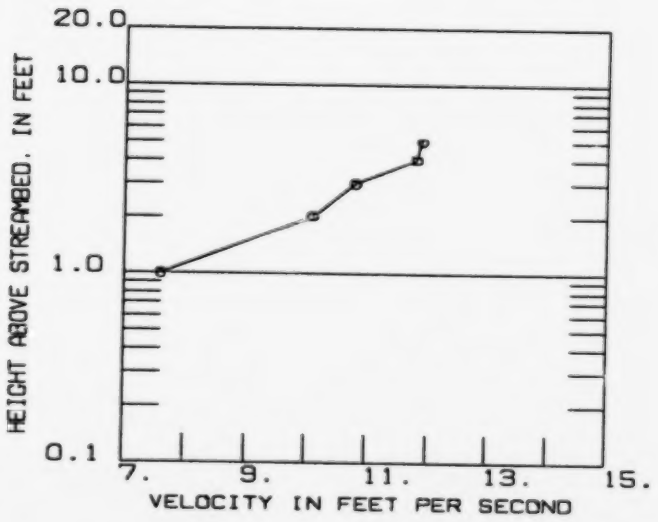
14242580 - Toutle River at Tower Road near Silver Lake, WA

June 7, 1985 File No.: 15.8

Depth: 6.0 ft
Stream discharge: 8,470 cubic feet per second
Mean velocity: 10.61 ft/s
Water-surface slope: 0.00556

Time	Height above bed (ft)	Velocity (ft/s)
1930	1.0	7.60
1930	2.0	10.10
1930	3.0	10.80
1930	4.0	11.80
1930	5.0	11.90





14242690 -- Toutle River at Highway 99 near Castle Rock, WA

LOCATION.--Lat 46°19'10", long 122°54'28", in NE1/4 SE1/4 sec. 27, T.10 N, R.2 W., Cowlitz County, Hydrologic Unit 17080005, on right bank at Old U.S. Highway 99 bridge, 3.0 mi north of Castle Rock, and at mile 1.0.

DRAINAGE AREA.--512 mi^2

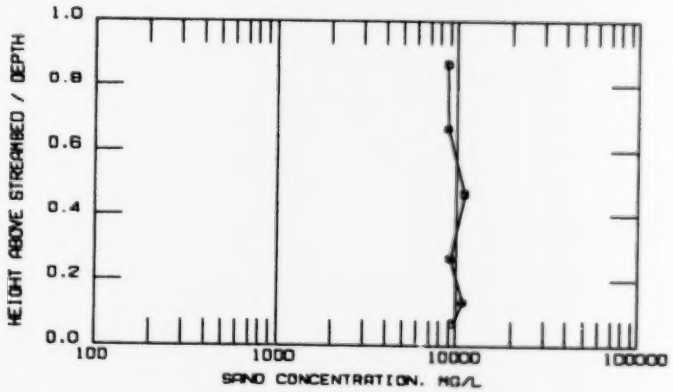
REACH DESCRIPTION.--The channel was altered on May 18, 1980 by conditions similar to those at the Toutle River at Tower Road. Although the bridge piers do not constrict the flow, the bridge is located at a channel constriction. During storm runoff, streamflow converges from two directions immediately above the bridge. This results in considerable mixing and turbulence at the sampling cross section. The channel has a sand bed at most stages.

14242690 - Toutle River at Highway 99 near Castle Rock, WA

January 23, 1982 File No.: 1.1

Depth: 15.0 ft
Water temperature: 7.0 degrees C
Stream discharge: 20,100 cubic feet per second

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Concentration, mg/L Coarser than 0.062
2103	1.0	--	20600	54	14.00	11100	9480
2123	2.0	--	22100	51	6.50	11300	10800
2130	4.0	--	20000	54	2.75	10800	9200
2135	7.0	--	21900	50	1.14	11000	11000
2145	10.0	--	19700	55	0.50	10800	8860
2150	13.0	--	19900	56	0.15	11100	8760
Z1						0.003	0.027

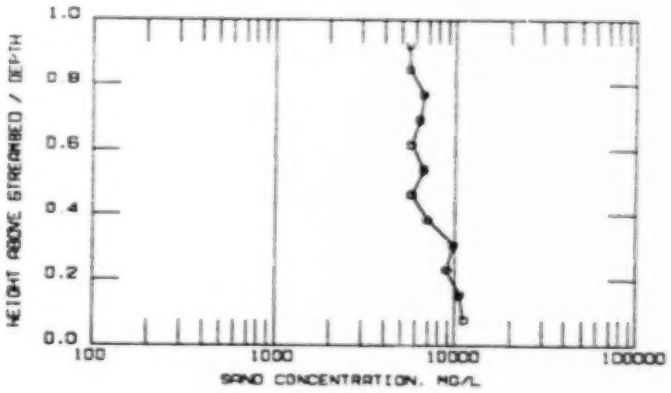


14242690 - Toutle River at Highway 99 near Castle Rock, WA

February 19, 1982 File No.: 2.1

Depth: 13.0 ft
Water temperature: 8.0 degrees C
Stream discharge: 10,800 cubic feet per second

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Concentration, mg/L Coarser than 0.062
1454	1.0	—	19100	42	12.00	8020	11100
1449	2.0	—	18400	43	5.50	7910	10500
1444	3.0	—	16800	47	3.33	7900	8900
1440	4.0	—	17900	46	2.25	8230	9670
1433	5.0	—	14600	52	1.60	7590	7010
1429	6.0	—	13200	57	1.17	7520	5680
1424	7.0	—	14100	53	0.86	7470	6630
1420	8.0	—	13400	58	0.63	7770	5630
1416	9.0	—	14000	55	0.44	7700	6300
1412	10.0	—	14400	54	0.30	7780	6620
1409	11.0	—	13200	58	0.18	660	5540
1404	12.0	—	13100	58	0.08	7600	5500
Z1						0.011	0.158

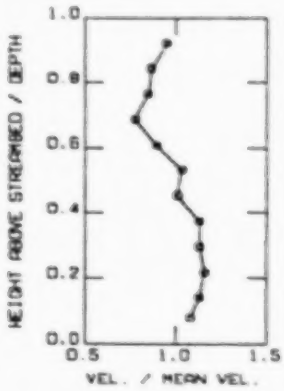


14242690 - Toutle River at Highway 99 near Castle Rock, WA

February 19, 1982 File No.: 2.2

Depth: 12.6 ft
Station: 105
Stream discharge: 11,200 cubic feet per second
Water temperature: 8.0 degrees C
Mean velocity: 9.14 ft/s
Water-surface slope: 0.00160

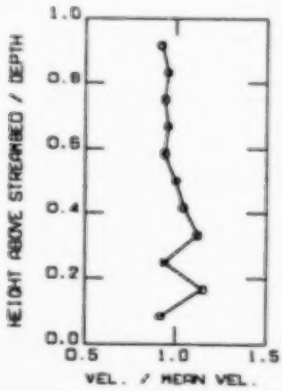
Time	Height above bed (ft)	Velocity (ft/s)
1330	1.0	9.89
1330	1.8	10.36
1330	2.8	10.62
1330	3.8	10.36
1330	4.8	10.36
1330	5.8	9.26
1330	6.8	9.46
1330	7.8	8.17
1330	8.8	7.11
1330	9.8	7.78
1330	10.8	7.93
1330	11.8	8.71



February 19, 1982 File No.: 2.3

Depth: 12.0 ft
Station: 105
Water temperature: 8.0 degrees C
Stream discharge: 10,800 cubic feet per second
Mean velocity: 9.44 ft/s
Water-surface slope: 0.00160

Time	Height above bed (ft)	Velocity (ft/s)
1515	1.0	8.71
1515	2.0	10.88
1515	3.0	8.89
1515	4.0	10.62
1515	5.0	9.89
1515	6.0	9.46
1515	7.0	8.89
1515	8.0	9.07
1515	9.0	8.89
1515	10.0	9.07
1515	11.0	8.71



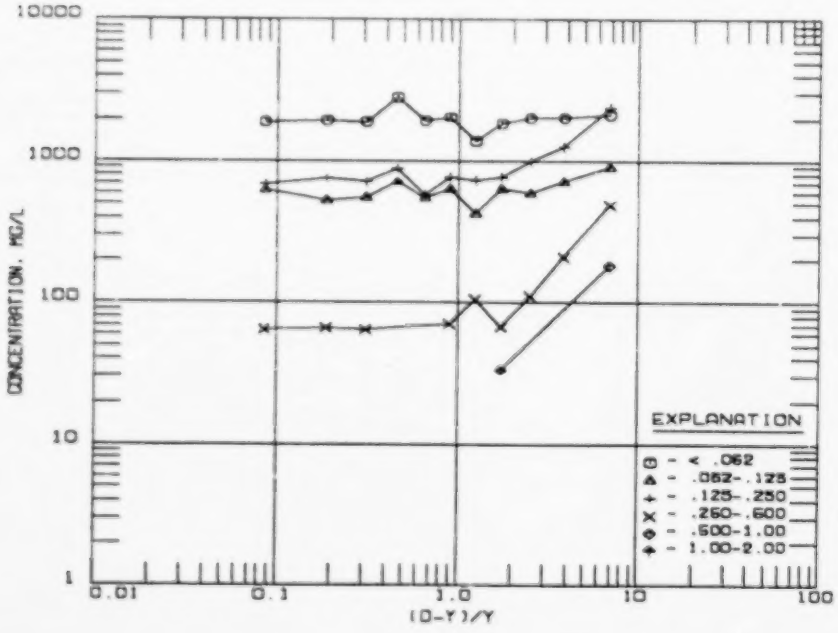
14242690 - Toutle River at Highway 99 near Castle Rock, WA

June 22, 1982 File No.: 3.1

Depth: 6.3 ft
Station: 26
Water temperature: 14.0 degrees C
Stream discharge: 1,150 cubic feet per second
Mean velocity: 4.87 ft/s
Water-surface slope: 0.00240

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1235	0.8	2.92	6110	35	50	89	97	100	
1232	1.3	3.50	4230	48	65	95	100		
1230	1.8	4.85	3730	54	70	97	100		
1227	2.3	4.48	3370	55	74	97	99	100	
1224	2.8	5.45	2650	52	68	96	100		
1222	3.3	5.74	3540	58	76	98	100		
1219	3.8	5.84	3080	63	81	100			
1217	4.3	5.45	4440	64	80	100			
1214	4.8	5.20	3230	59	76	98	100		
1212	5.3	4.48	3310	59	75	98	100		
1208	5.8	4.48	3250	58	77	98	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1235	6.88	2140	916	2380	489	183		3970
1232	3.85	2030	719	1270	212			2200
1230	2.50	2010	597	1010	112			1720
1227	1.74	1850	640	775	67	34		1520
1224	1.25	1380	424	742	106			1270
1222	0.91	2050	637	779	71			1490
1219	0.66	1940	554	585				1140
1217	0.47	2840	710	888				1600
1214	0.31	1910	549	711	65			1320
1212	0.19	1950	530	761	66			1360
1208	0.09	1880	618	682	65			1360
Z1		0.000	0.069	0.214	0.372			0.184



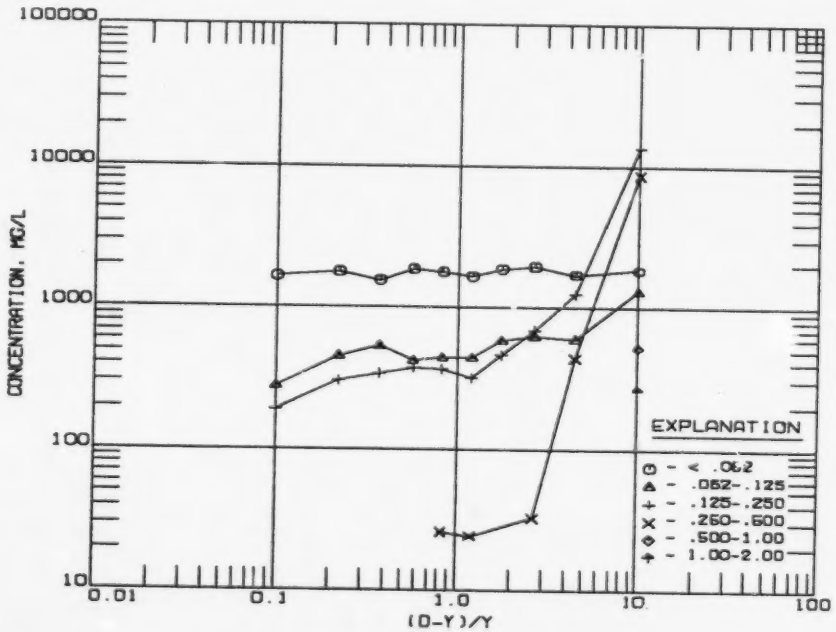
14242690 - Toutle River at Highway 99 near Castle Rock, WA

June 22, 1982 File No.: 3.2

Depth: 6.6 ft
Station: 33
Water temperature: 14.0 degrees C
Stream discharge: 1,150 cubic feet per second
Mean velocity: 6.84 ft/s
Water-surface slope: 0.00240

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1309	0.6	5.20	26400	7	12	64	97	99	100
1309	1.2	6.41	4000	43	58	89	100		
1303	1.8	6.96	3290	59	78	99	100		
1303	2.4	7.11	2930	64	84	100			
1258	3.0	7.11	2450	68	86	99	100		
1256	3.6	7.11	2610	68	85	99	100		
1253	4.2	6.81	2650	70	86	100			
1251	4.8	6.96	2430	64	86	100			
1249	5.4	6.81	2540	70	88	100			
1246	6.0	7.43	2120	78	91	100			

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1309	10.00	1850	1320	13700	8710	528	264	24600
1309	4.50	1720	600	1240	440			2280
1303	2.67	1940	625	691	33			1350
1303	1.75	1880	586	469				1050
1258	1.20	1670	441	318	24			784
1256	0.83	1770	444	365	26			835
1253	0.57	1860	424	371				795
1251	0.37	1560	535	340				875
1249	0.22	1780	457	305				762
1246	0.10	1650	276	191				466
Z1		0.024	0.245	0.719	2.348			0.639



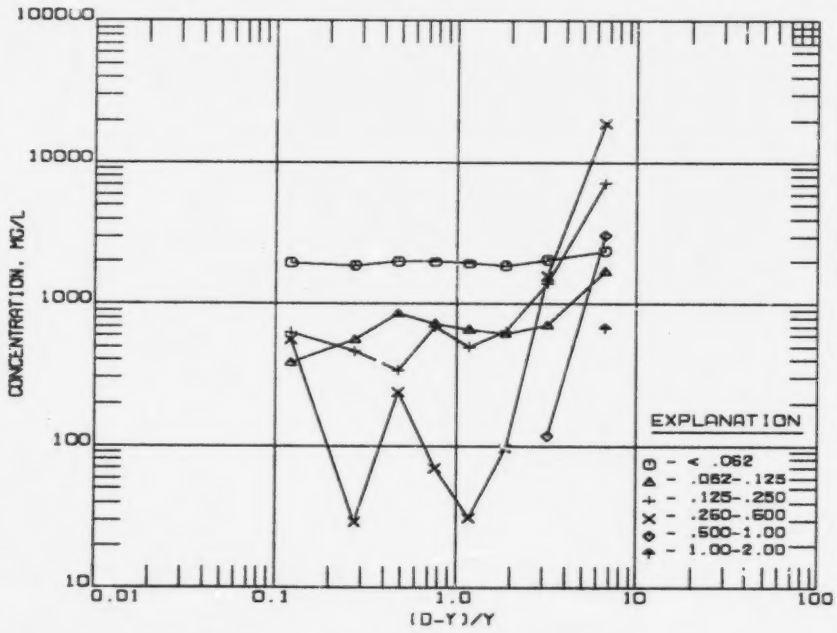
14242690 - Toutle River at Highway 99 near Castle Rock, WA

June 22, 1982 File No.: 3.3

Depth: 4.6 ft
Station: 39
Water temperature: 14.0 degrees C
Stream discharge: 1,150 cubic feet per second
Mean velocity: 7.52 ft/s
Water-surface slope: 0.00240

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1336	0.6	6.41	34000	7	12	33	89	98	100
1331	1.1	6.67	5870	35	47	71	98	100	
1328	1.6	7.43	3220	58	77	97	100		
1326	2.1	7.60	3130	62	83	99	100		
1323	2.6	7.43	3480	57	78	98	100		
1321	3.1	7.60	3440	58	83	93	100		
1318	3.6	7.97	2930	64	83	99	100		
1316	4.1	9.46	3530	55	66	84	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1336	6.67	2380	1700	7140	19000	3060	680	31600
1331	3.18	2050	704	1410	1580	117		3820
1328	1.88	1870	612	644	97			1350
1326	1.19	1940	657	501	31			1190
1323	0.77	1980	731	696	70			1500
1321	0.48	2000	860	344	241			1440
1318	0.28	1880	557	469	29			1050
1316	0.12	1940	388	635	565			1590
Z1		0.038	0.248	0.536	0.902			0.611



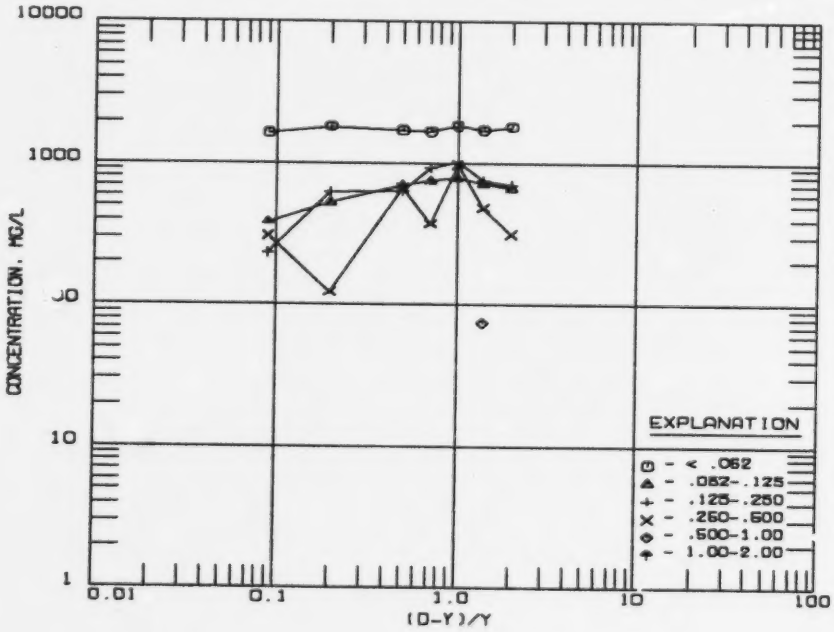
14242690 - Toutle River at Highway 99 near Castle Rock, WA

June 22, 1982 File No.: 3.4

Depth: 2.4 ft
Station: 50
Water temperature: 14.0 degrees C
Stream discharge: 1,150 cubic feet per second
Mean velocity: 7.42 ft/s
Water-surface slope: 0.00240

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1359	0.8	5.95	3510	52	71	91	100		
1355	1.0	5.95	3740	46	65	85	98	100	
1354	1.2	6.96	4640	40	57	79	100		
1351	1.4	6.96	3750	45	65	90	100		
1349	1.6	6.67	3730	46	65	82	100		
1346	1.8	8.54	9850	14	56	93	100		
1344	2.0	9.07	3090	59	76	96	100		
1341	2.2	9.67	2560	64	79	88	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1359	2.00	1830	667	702	316			1680
1355	1.40	1720	711	748	486	75		2020
1354	1.00	1860	789	1020	974			2780
1351	0.71	1690	750	938	375			2060
1349	0.50	1720	709	634	671			2010
1346	0.33	1380	4140	3640	690			8470
1344	0.20	1820	525	618	124			1270
1341	0.09	1640	384	230	307			922
Z1		0.034	0.075	0.230	0.234			0.153



14242690 - Toutle River at Highway 99 near Castle Rock, WA

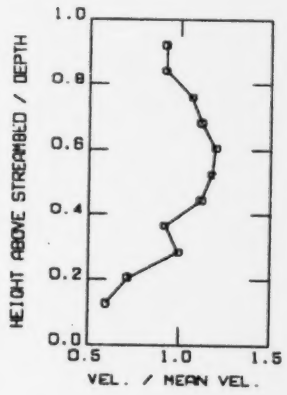
June 22, 1982 File No.: 3.5

Depth: 1.3 ft
Station: 74
Water temperature: 14.0 degrees C
Stream discharge: 1,150 cubic feet per second
Water-surface slope: 0.00240

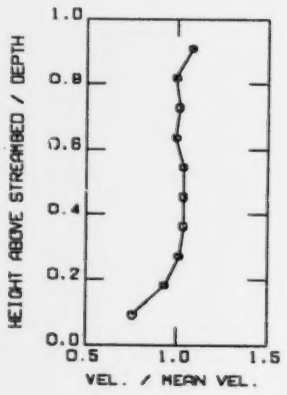
Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm					
				0.062	0.125	0.250	0.500	1.00	2.00
1409	0.9	5.45	3050	59	81	98	100		
1404	1.1	5.84	2560	72	91	100			

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1409	0.44	1800	671	518	61			1250
1404	0.18	1840	486	230				717

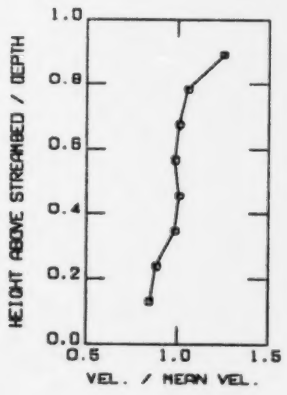
Vertical Profiles File Nos. 3.1 - 3.4



3.1



3.2



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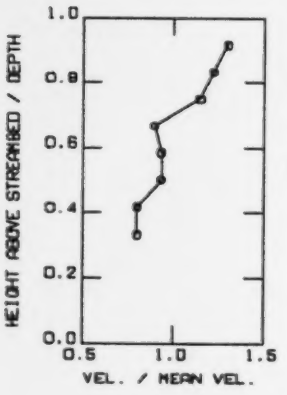


3.4

14243000 -- Cowlitz River at Castle Rock, WA

LOCATION.--Lat 46°16'30", long 122°54'48", in SW1/4 SE1/4 sec.10, T.9 N., R.2 W., Cowlitz County, Hydrologic Unit 17080005, on left bank 40 ft downstream from Arkansas Valley Road bridge in Castle Rock, 2.7 mi downstream from Toutle River, and at mile 17.3.

DRAINAGE AREA.--2,238 mi^2.

REACH DESCRIPTION.--Over one hundred million tons of sediment were transported into the Cowlitz River channel from the Toutle River during the mudflows of the May 18, 1980 eruption. The channel width remains uniform 1,000 feet above and below the bridge cross section. The stream has a sand bed.

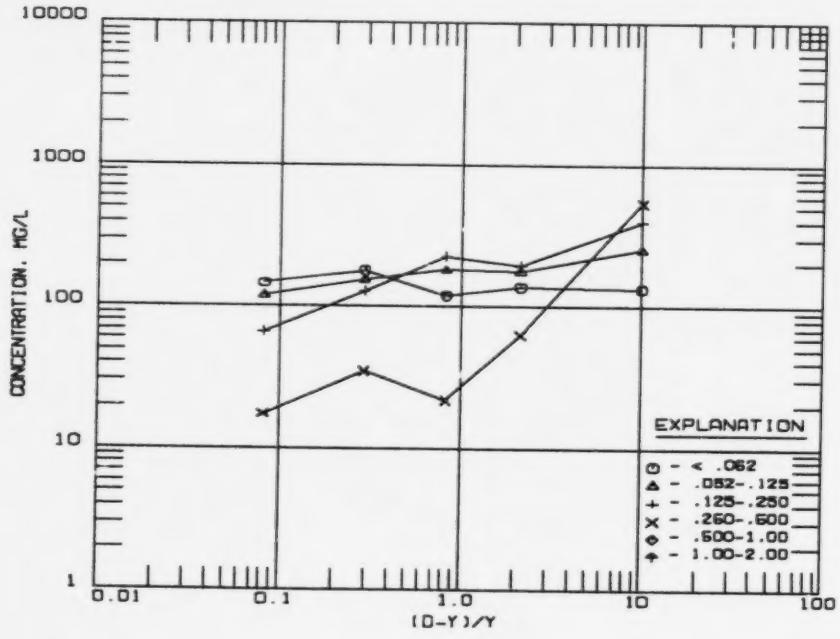
14243000 - Cowlitz River at Castle Rock, WA

January 14, 1981 File No.: 1.1

Depth: 6.6 ft
Stream discharge: 11,700 cubic feet per second
Water temperature: 7.5 degrees C
Station: 94
Mean velocity: 4.21 ft/s
Water-surface slope: 0.00034

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1323	0.6	2.99	1330	10	29	59	100		
1325	2.1	4.07	578	24	55	89	100		
1326	3.6	4.37	547	22	55	96	100		
1327	5.1	4.65	496	36	67	93	100		
1328	6.1	4.85	348	42	76	95	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1323	10.00	133	253	399	545			1200
1325	2.14	139	179	197	64			439
1326	0.83	120	181	224	22			427
1327	0.29	179	154	129	35			317
1328	0.08	146	118	66	17			202
Z1		-0.036	0.146	0.350	0.664			0.343



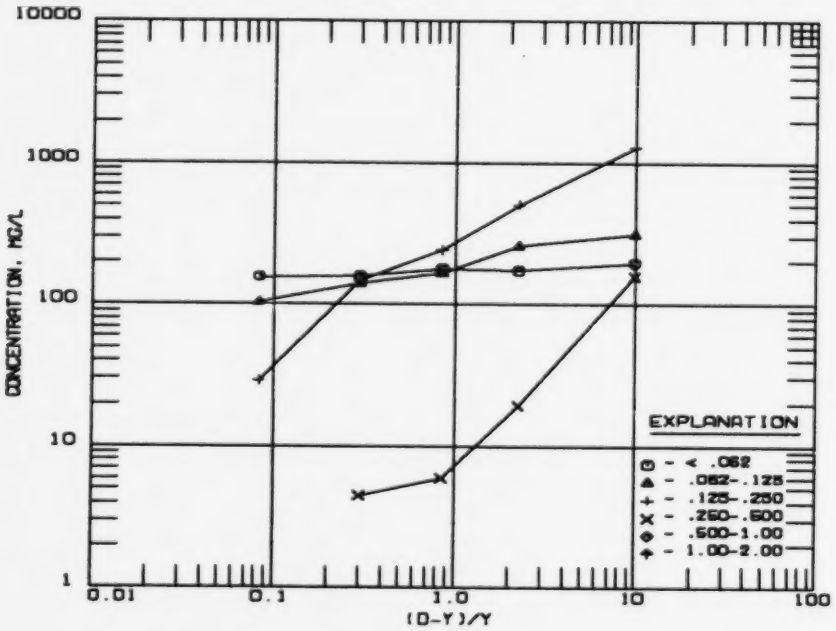
14243000 - Cowlitz River at Castle Rock, WA

January 14, 1981 File No.: 1.2

Depth: 6.5 ft
Station: 154
Water temperature: 7.5 degrees C
Stream discharge: 11,700 cubic feet per second
Mean velocity: 6.95 ft/s
Water-surface slope: 0.00034

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1350	0.6	5.32	1980	10	26	92	100		
1353	1.0	6.67	961	18	45	98	100		
1355	3.5	6.96	592	30	58	99	100		
1357	4.0	7.26	449	35	66	99	100		
1357	6.0	7.26	290	54	90	100			

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1350	9.83	198	317	1310	158			1780
1353	5.50	173	259	509	19			788
1355	0.86	178	166	243	6			414
1357	0.63	157	139	148	4			292
1357	0.08	157	104	29				133
Z1		0.042	0.236	0.740	1.105			0.507



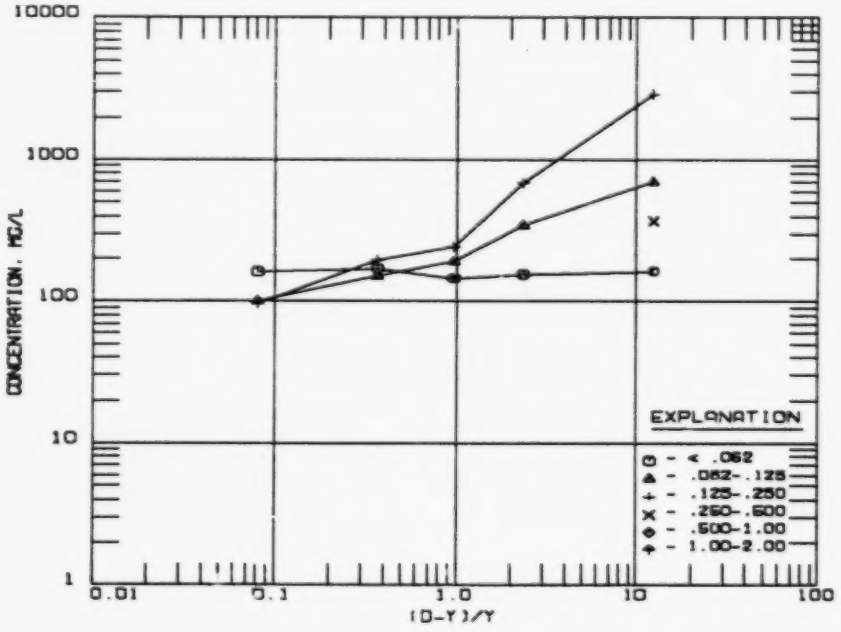
14243000 - Cowlitz River at Castle Rock, WA

January 14, 1981 File No.: 1.3

Depth: 6.7 ft
Stream discharge: 11,700 cubic feet per second
Water temperature: 7.5 degrees C
Station: 204
Mean velocity: 6.84 ft/s
Water-surface slope: 0.00034

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1430	0.5	4.96	4100	4	21	91	100		
1432	2.0	6.54	1190	13	42	100			
1433	3.4	7.26	583	25	58	100			
1435	4.9	7.60	517	33	62	100			
1436	6.2	7.11	359	45	73	100			

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1430	12.40	164	697	2870	369			3940
1432	2.35	155	345	690				1040
1433	0.97	146	192	245				437
1435	0.37	171	150	196				346
1436	0.08	162	101	97				197
Z1		-0.004	0.393	0.675				0.595



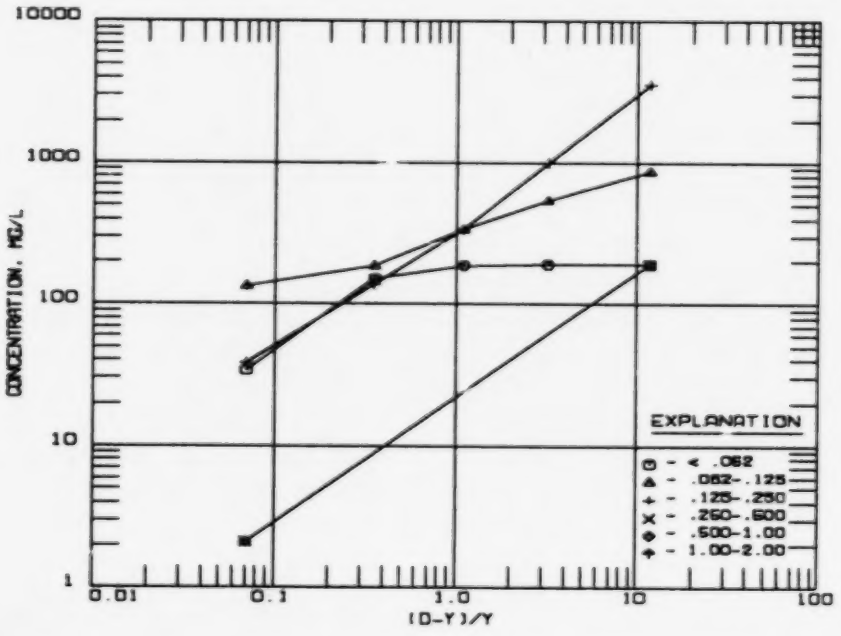
14243000 - Cowlitz River at Castle Rock, WA

January 14, 1981 File No.: 1.4

Depth: 7.6 ft
Station: 252
Water temperature: 7.5 degrees C
Stream discharge: 11,700 cubic feet per second
Mean velocity: 7.19 ft/s
Water-surface slope: 0.00034

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1442	0.6	5.32	4830	4	22	96	100		
1445	1.8	6.41	1740	11	42	100			
1448	3.6	7.26	858	22	61	100			
1450	5.6	7.60	476	32	71	100			
1451	7.1	9.07	212	16	80	98	99	100	

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1442	11.67	193	869	3570	193			4640
1445	3.22	191	539	1010				1550
1448	1.11	189	335	335				669
1450	0.36	152	186	138				324
1451	0.07	34	136	38	2	2		178
Z1		0.314	0.381	0.888				0.644



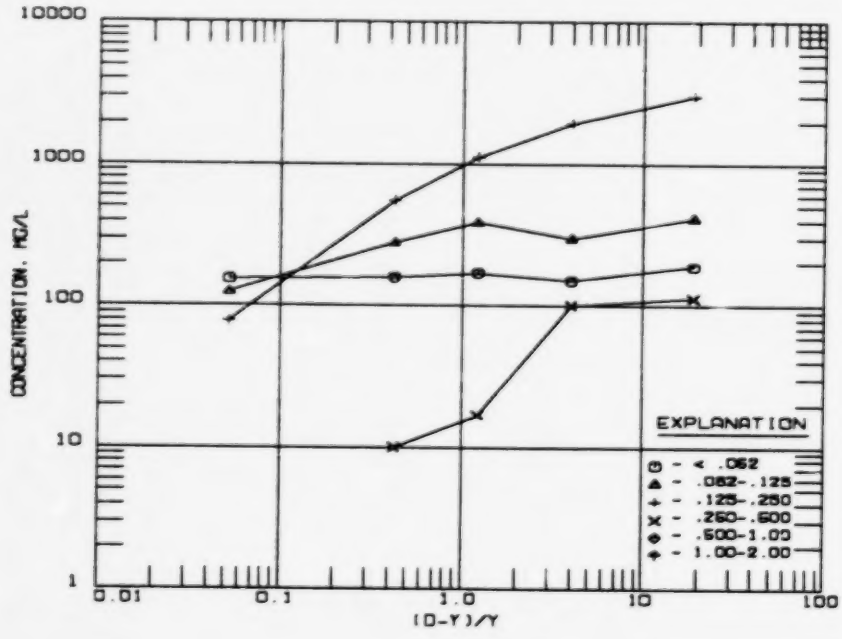
14243000 - Cowlitz River at Castle Rock, WA

January 14, 1981 File No.: 1.5

Depth: 10.0 ft
Station: 296
Water temperature: 7.5 degrees C
Stream discharge: 11,700 cubic feet per second
Mean velocity: 5.03 ft/s
Water-surface slope: 0.00034

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1500	0.5	1.65	3790	5	16	97	100		
1502	2.0	2.50	2510	6	18	96	100		
1503	4.5	5.64	1700	10	33	99	100		
1508	7.0	6.41	1000	16	44	99	100		
1510	9.5	7.11	358	43	78	100			

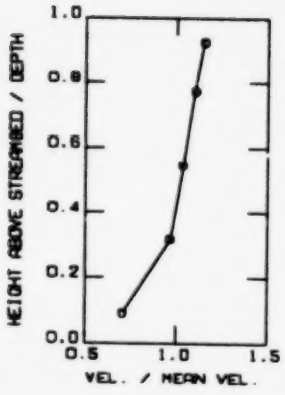
		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1500	19.00	190	417	3070	114			3600
1502	4.00	151	301	1960	100			2360
1503	1.22	170	391	1120	17			1530
1508	0.43	160	280	550	10			840
1510	0.05	154	125	79				204
Z1		0.026	0.186	0.624	0.705			0.490



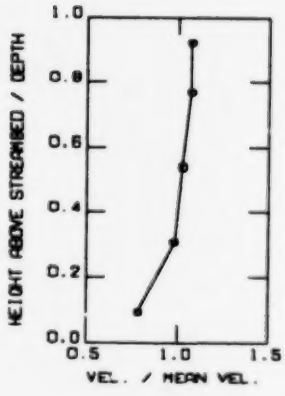
14243000 - Cowlitz River at Castle Rock, WA

January 14, 1981 File Nos. 1.1 - 1.5

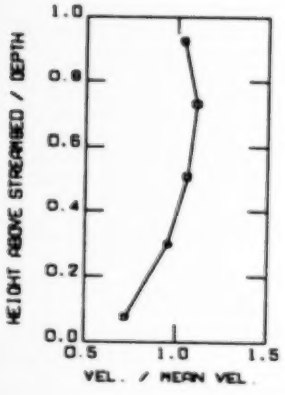
Velocity Profiles



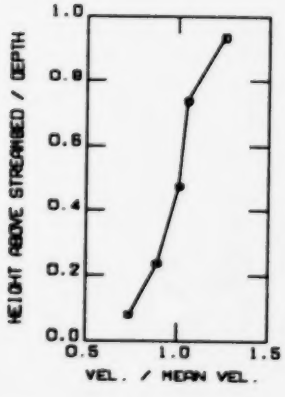
1.1



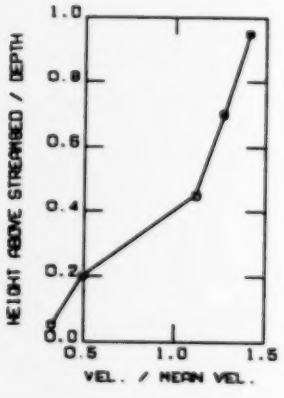
1.2



1.3



1.4



1.5

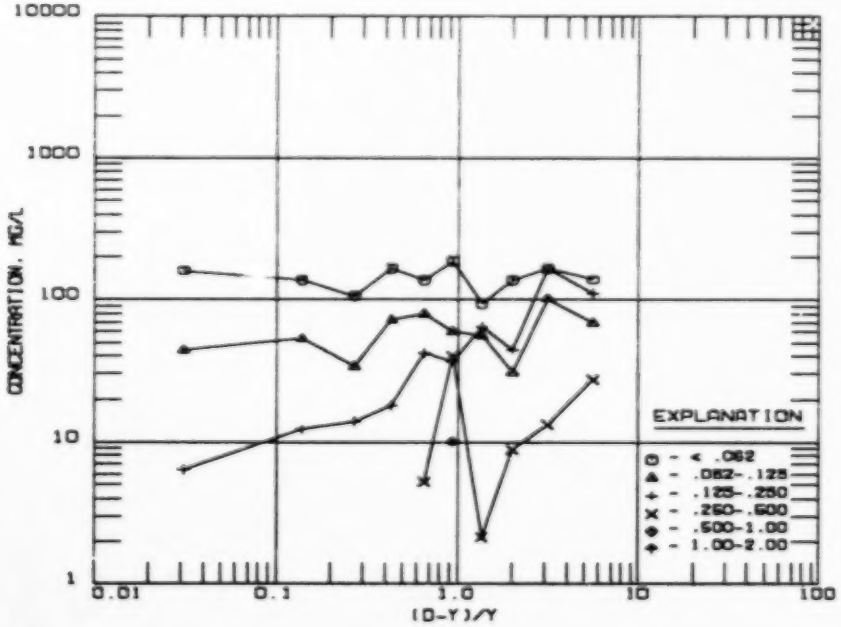
14243000 - Cowlitz River at Castle Rock, WA

June 30, 1982 File No.: 2.1

Depth: 6.6 ft
Station: 168
Water temperature: 12.0 degrees C
Stream discharge: 7,110 cubic feet per second
Mean velocity: 3.17 ft/s
Water-surface slope: 0.00050

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1355	1.0	2.00	348	40	60	92	100		
1355	1.6	2.68	445	37	60	97	100		
1355	2.2	2.92	224	62	76	96	100		
1355	2.8	3.13	217	43	69	99	100		
1355	3.4	3.13	337	56	74	85	97	100	
1355	4.0	3.28	266	52	82	98	100		
1355	4.6	3.28	258	65	93	100			
1355	5.2	3.57	154	69	91	100			
1355	5.8	3.89	204	68	94	100			
1405	6.4	3.28	211	76	97	100			

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1355	5.60	139	70	111	28			209
1355	3.13	165	102	165	13			280
1355	2.00	139	31	45	9			85
1355	1.36	93	56	65	2			124
1355	0.94	189	61	37	40	10		148
1355	0.65	138	80	43	5			128
1355	0.43	168	72	18				90
1355	0.27	106	34	14				48
1355	0.14	139	53	12				65
1405	0.03	160	44	6				51
Z1		-0.008	0.089	0.629	0.475			0.312



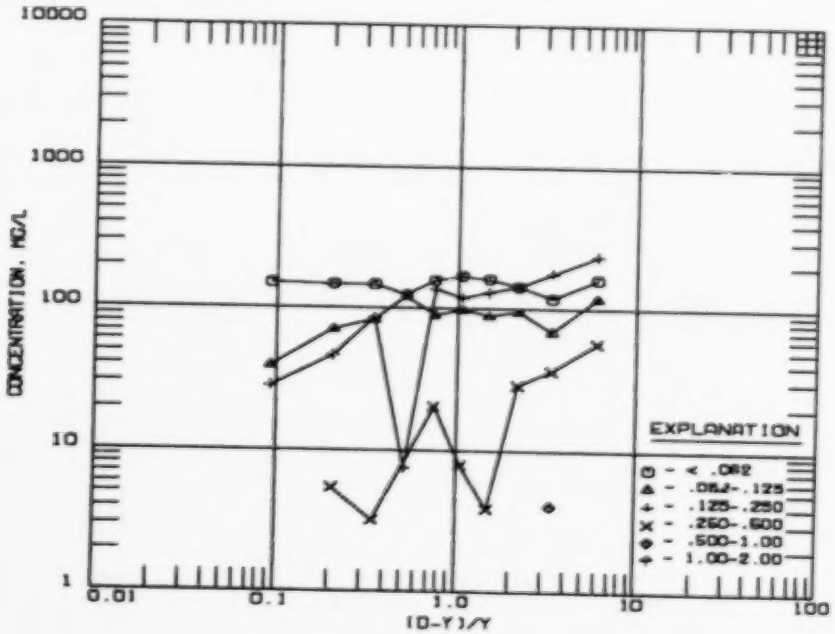
14243000 - Cowlitz River at Castle Rock, WA

June 30, 1982 File No.: 2.2

Depth: 7.0 ft
Station: 209
Water temperature: 12.0 degrees C
Stream discharge: 7,110 cubic feet per second
Mean velocity: 4.25 ft/s
Water-surface slope: 0.00050

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1410	1.0	3.57	574	28	49	90	100		
1410	1.6	3.80	410	29	46	90	99	100	
1410	2.2	4.07	415	35	58	93	100		
1410	2.8	4.26	387	42	65	99	100		
1410	3.4	4.26	396	43	68	98	100		
1410	4.0	4.37	407	39	61	95	100		
1410	4.6	4.48	253	49	97	100			
1410	5.2	4.48	319	46	72	99	100		
1410	5.8	4.48	271	55	81	98	100		
1422	6.4	4.48	218	69	87	100			

Time	(D-Y)/Y	Concentration, in mg/L, of size class, in mm: Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1410	6.00	161	121	235	57			413
1410	3.38	119	70	180	37	4		291
1410	2.18	145	95	145	29			270
1410	1.50	163	89	132	4			224
1410	1.06	170	99	119	8			226
1410	0.75	159	90	138	20			248
1410	0.52	124	121	8				129
1410	0.35	147	83	86	3			172
1410	0.21	149	70	46	5			122
1422	0.09	150	39	28				68
Z1		-0.002	0.160	0.553	0.762			0.384



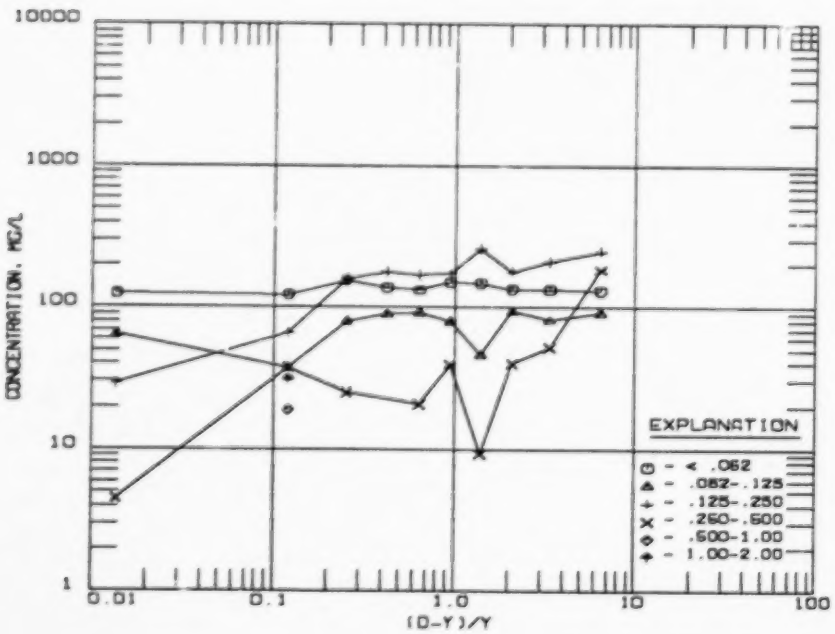
14243000 - Cowlitz River at Castle Rock, WA

June 30, 1982 File No.: 2.3

Depth: 7.4 ft
Station: 260
Water temperature: 12.0 degrees C
Stream discharge: 7,110 cubic feet per second
Mean velocity: 4.32 ft/s
Water-surface slope: 0.00050

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1440	1.0	3.80	660	20	34	72	100		
1440	1.7	3.80	476	28	45	89	100		
1440	2.4	3.98	451	30	51	91	100		
1440	3.1	4.37	463	32	42	98	100		
1440	3.8	4.37	442	34	52	91	100		
1440	4.5	4.37	415	32	54	95	100		
1440	5.2	4.65	408	34	56	100			
1440	5.9	4.75	421	37	56	94	100		
1440	6.6	4.75	314	39	51	72	84	90	100
1449	7.3	--	223	56	85	98	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1440	6.40	132	92	251	185			528
1440	3.35	133	81	209	52			343
1440	2.08	135	95	180	41			316
1440	1.39	148	46	259	9			315
1440	0.95	150	80	172	40			292
1440	0.64	133	91	170	21			282
1440	0.42	139	90	180				269
1440	0.25	156	80	160	25			265
1440	0.12	122	38	66	38	19	31	192
1449	0.01	125	65	29	4			98
Z1		0.013	0.073	0.347	0.412			0.235



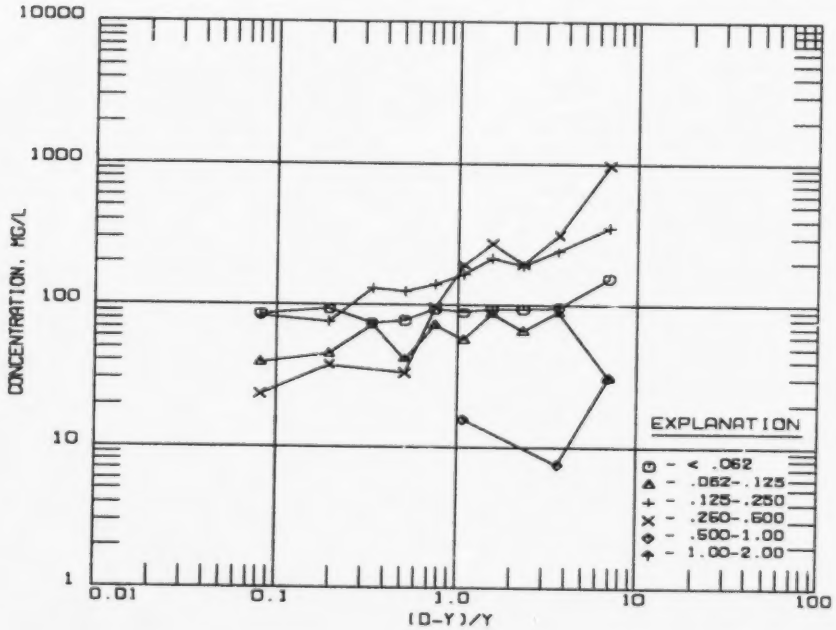
14243000 - Cowlitz River at Castle Rock, WA

June 30, 1982 File No.: 2.4

Depth: 7.9 ft
Station: 304
Water temperature: 12.0 degrees C
Stream discharge: 7,110 cubic feet per second
Mean velocity: 4.13 ft/s
Water-surface slope: 0.00050

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1453	1.0	3.31	1550	10	12	35	98	100	
1453	1.7	3.43	749	13	25	57	99	100	
1453	2.4	3.57	550	17	29	64	100		
1453	3.1	3.80	673	14	27	59	100		
1453	3.8	4.26	523	17	28	60	97	100	
1453	4.5	4.07	406	23	41	76	100		
1453	5.2	4.48	278	28	43	88	100		
1453	5.9	4.48	278	27	53	100			
1453	6.6	4.96	253	37	55	85	100		
1508	7.3	4.96	233	37	54	90	100		

		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1453	6.90	155	31	356	976	31		1400
1453	3.65	97	90	240	315	7		652
1453	2.29	94	66	192	198			456
1453	1.55	94	87	215	276			579
1453	1.08	89	58	167	194	16		434
1453	0.76	93	73	142	97			313
1453	0.52	78	42	125	33			200
1453	0.34	75	72	131				203
1453	0.20	94	46	76	38			159
1508	0.08	86	40	84	23			147
Z1		0.096	0.053	0.335	0.831	0.238		0.505



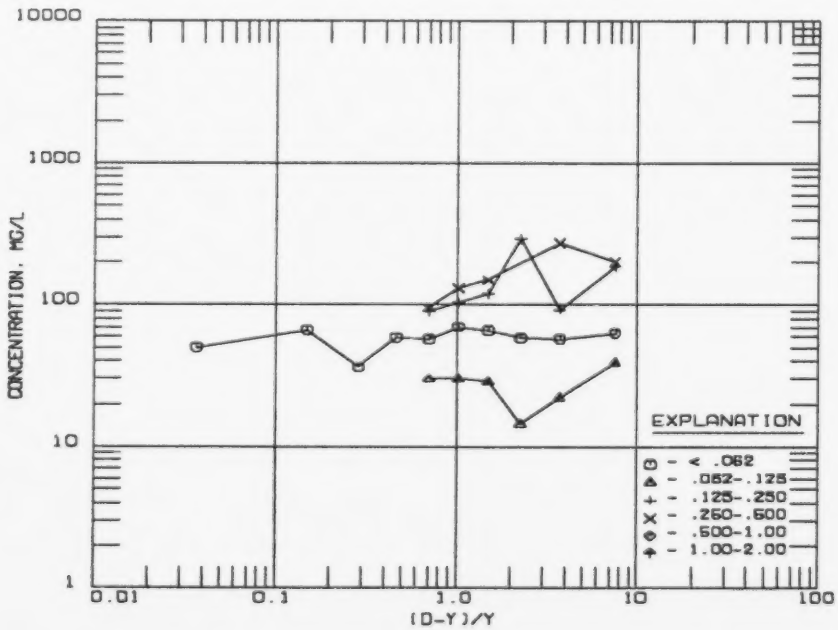
14243000 - Cowlitz River at Castle Rock, WA

June 30, 1982 File No.: 2.5

Depth: 8.5 ft
Station: 354
Stream discharge: 7,110 cubic feet per second
Water temperature: 12.0 degrees C
Mean velocity: 4.10 ft/s
Water-surface slope: 0.00050

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than indicated size, in mm 0.062	0.125	0.250	0.500	1.00	2.00
1511	1.0	2.80	487	13	21	59	100		
1511	1.8	3.57	443	13	18	39	100		
1511	2.6	3.98	366	16	20	100			
1511	3.4	3.98	365	18	26	59	100		
1511	4.2	4.26	334	21	30	61	100		
1511	5.0	4.16	273	21	32	65	100		
1511	5.8	4.37	218	27					
1511	6.6	4.48	151	24					
1511	7.4	4.48	148	45					
1525	8.2	4.37	86	58					

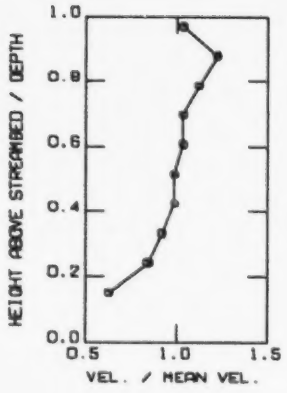
		Concentration, in mg/L, of size class, in mm						
Time	(D-Y)/Y	Finer than 0.062	0.062 to 0.125	0.125 to 0.250	0.250 to 0.500	0.500 to 1.00	1.00 to 2.00	Coarser than 0.062
1511	7.50	63	39	185	200			424
1511	3.72	58	22	93	270			385
1511	2.27	59	15	293				307
1511	1.50	66	29	120	150			299
1511	1.02	70	30	104	130			264
1511	0.70	57	30	90	96			216
1511	0.47	59						159
1511	0.29	36						115
1511	0.15	67						81
1525	0.04	50						36
Z1		0.045	0.021	0.243	0.349			0.482



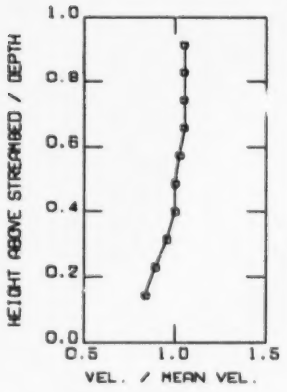
14243000 - Cowlitz River at Castle Rock, WA

June 30, 1982 File Nos. 2.1 - 2.5

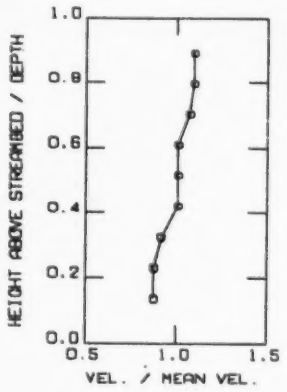
Velocity Profiles



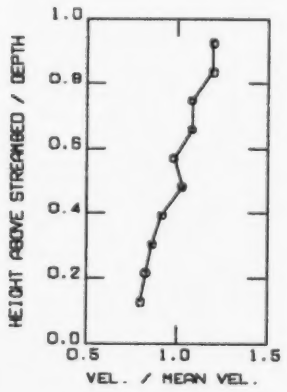
2.1



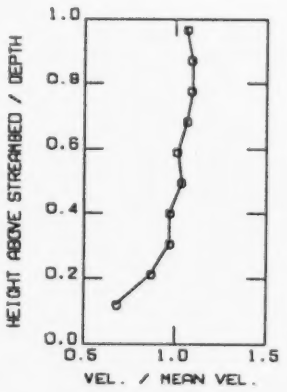
2.2



2.3



2.4



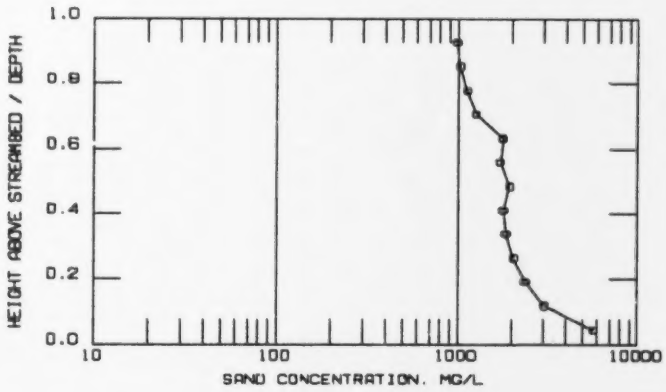
2.5

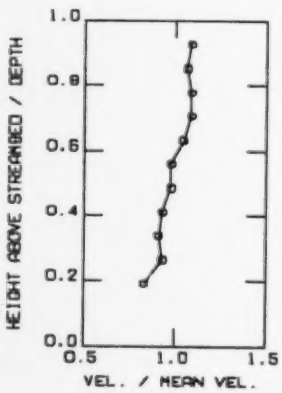
14243000 - Cowlitz River at Castle Rock, WA

March 10, 1983 File No.: 3.1

Depth: 6.8 ft
Water temperature: 9.5 degrees C
Stream discharge: 22,000 cubic feet per second
Mean velocity: 8.33 ft/s
Water-surface slope: 0.00090

Time	Height above bed (ft)	Velocity (ft/s)	Concentration (mg/L)	Percent finer than 0.062	(D-Y)/Y	Concentration, mg/L Finer than 0.062	Coarser than 0.062
1209	0.3	--	9340	39	21.67	3640	5700
1206	0.8	--	6460	53	7.50	3420	3040
1204	1.3	6.96	5830	59	4.23	3440	2390
1201	1.8	7.78	5500	63	2.78	3460	2040
1158	2.3	7.60	5160	64	1.96	3300	1860
1156	2.8	7.78	5120	65	1.43	3330	1790
1154	3.3	8.17	5390	64	1.06	3450	1940
1150	3.8	8.17	5040	66	0.79	3330	1710
1148	4.3	8.71	5080	65	0.58	3300	1780
1146	4.8	9.07	4510	72	0.42	3250	1260
1144	5.3	9.07	4340	74	0.28	3210	1130
1141	5.8	8.89	4120	75	0.17	3090	1030
1138	6.3	9.07	4120	76	0.08	3130	989
Z1						0.026	0.292





14243000 - Cowlitz River at Castle Rock, WA

March 10, 1983 File No.: 3.2

Depth: 6.6 ft
Stream discharge: 22,000 cubic feet per second
Water temperature: 9.5 degrees C
Mean velocity: 8.36 ft/s
Water-surface slope: 0.00090

Time	Height above bed (ft)	Velocity (ft/s)
1217	1.0	7.26
1218	1.6	7.60
1219	2.1	8.17
1220	2.6	8.38
1221	3.1	8.54
1222	3.6	8.71
1223	4.1	8.89
1224	4.6	8.71
1225	5.1	8.89
1226	5.6	8.89
1227	6.1	9.07
1228	6.6	9.89